

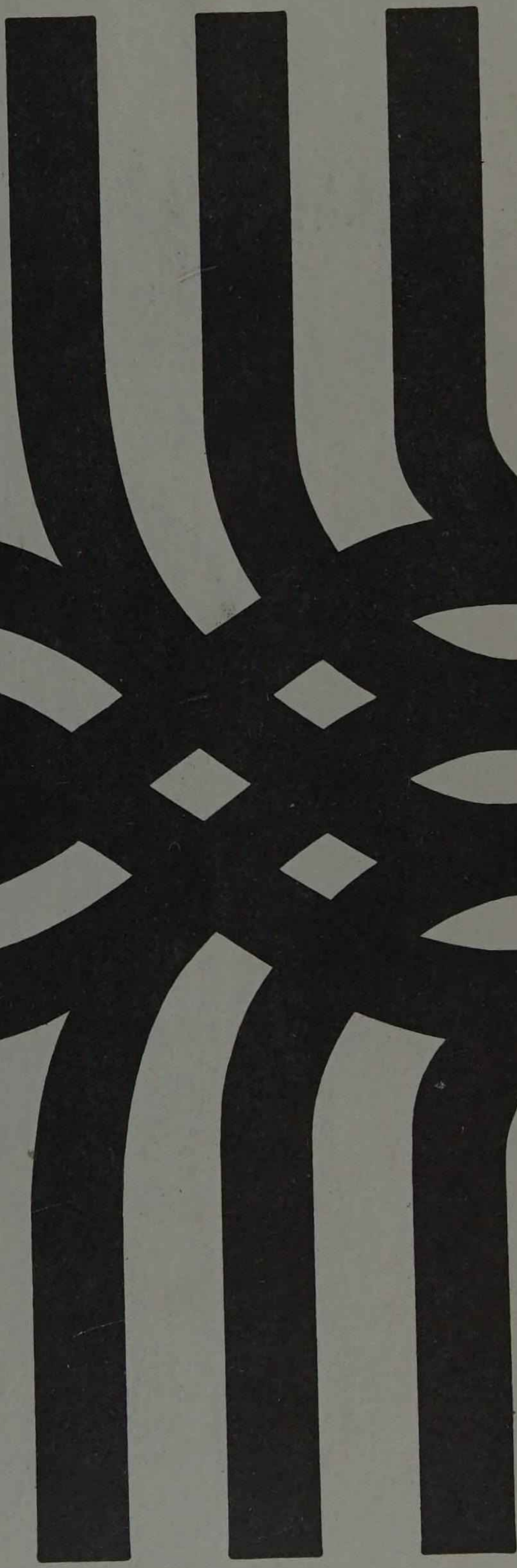
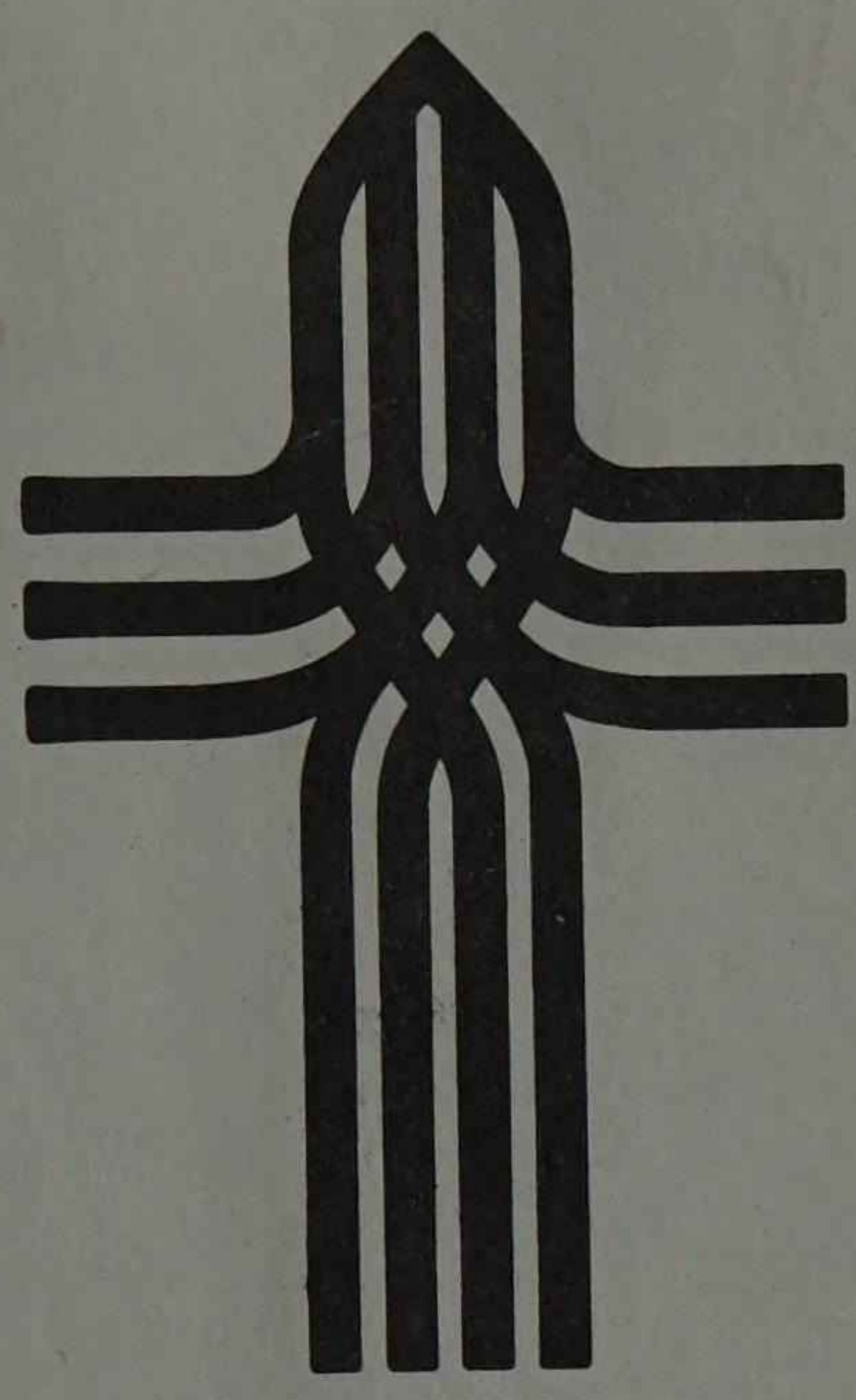
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MAN REACHES THE MOON

BY

B. Jack Long

The United States manned space programs have involved three spacecraft--the Mercury, Gemini, and Apollo. The Mercury made six manned flights, of which two were suborbital and four were earth orbital. The Mercury spacecraft has approximately 50 cubic feet of usable space for the astronaut. The Gemini spacecraft has made three manned flights to date. It has a usable volume for the astronauts of 70 cubic feet total, or 35 cubic feet per astronaut. The Apollo spacecraft will house three astronauts for a total usable volume for the crew of 225 cubic feet or 75 cubic feet per astronaut. It is interesting to note on this chart that the Saturn V launch vehicle which has an initial thrust in the first stage of $7\frac{1}{2}$ million pounds can place 250,000 pounds into a circular orbit 100 miles above the earth or inject 94,000 pounds to the moon.

The Saturn V launch vehicle with the Apollo has a total height of 360 feet. It weighs 6 million pounds at liftoff and is comprised of three stages; i.e. a first stage the S-IC built by Boeing, the S-II built by North American Aviation, and the third stage S-IVB built by Douglas Aircraft. NASA considers the Apollo spacecraft as everything forward of the S-IVB stage. The launch escape system provides a method of escape during an abort in the early portion of the mission. The boost protective cover is a flexible dacron skirt that protects the command module from ablative charring during aerodynamic heating which occurs on the launch phase out of the earth's atmosphere. The command module houses the three astronauts during the entire mission except for that portion of the mission when two of the astronauts are transferred to the lunar excursion module for the lunar landing. The service module provide services during the entire mission and is separated from the command module only a matter of minutes prior to reentry into the earth's atmosphere. The adapter section is purely a housing for the lunar excursion module during the early portion of the lunar mission, i.e., up through translunar injection.

North American Aviation, Space & Information Systems Division, has the following contractual responsibilities to NASA Manned Spaceflight Center, Houston, Texas, for the development and manufacturing of the spacecraft: the command module, service module, launch escape system, spacecraft lunar excursion module adapter, ground support equipment, spare parts for the preceding items, part task trainers and evaluators, management of major subcontractors, operation of all North American Aviation facilities, and test site activation. In the execution of this contract, North American Aviation must interface with many associate contractors who have contracts directly with NASA for the development of certain subsystems and other portions of the Saturn V launch vehicle systems.

The launch escape system is connected to the command module by a titanium tower with a boost protective cover made of flexible dacron to shield the command module from aerodynamic heating during the initial launch phase. The main launch escape system motor is 155,000 pounds of thrust exhausting through four nozzles. This solid propellant rocket is manufactured by Lockheed in Redlands, California. Two other small solid propellant rocket motors provide the ability to jettison the launch escape system whether it is used for abort purposes or whether it is jettisoned as required during the normal mission. A small pitch motor depresses the trajectory to one side during an abort situation or when jettisoning during the normal mission. Canard aerodynamic surfaces mounted on the nose of the launch escape system are opened during the abort situation to create pitching moment which will place the command module into an attitude wherein the relative wind will be pointing towards the bottom or broad base of the command module. This will place the command module into an aerodynamic attitude that will be complementary for streaming the earth landing system.

The command module is the mission crew compartment and provides the environmental control system devices for maintaining proper cabin environment for the astronauts during the entire mission. The command module also houses the flight control system which includes the stabilization and control system, guidance and navigation system, and reaction control system for attitude control during the reentry phase, and the communications systems. On top of the command module is located the lunar excursion module docking mechanism which provides a connecting mechanism to join and hold the command service modules and lunar excursion module during the trans-lunar portion of the mission, and for lunar orbital rendezvous. The command module also serves as the reentry by the stainless steel honeycomb heat shield and ablative material covering. The command module also houses the entire earth landing system which includes two drogue chutes, three pilot chutes, and three main chutes.

Significant features of the exterior of the command module include the crew access hatch which is used only during ingress and egress on the surface of the earth. Also noted are dual rocket motors, i.e., reaction controls which provide pitch, yaw, and roll control for the command module just prior to and during reentry into the earth's atmosphere. Two forward looking windows are provided for rendezvous with the lunar excursion module and two side windows are provided also. The umbilical tunnel is opposite the crew access hatch and located near the base of the command module. This umbilical tunnel connects all of the service module systems which are required to support the command module. An instrument access hatch is located above the umbilical tunnel in the crew compartment area. This hatch can be opened during space flight to extend the space telescope and sextant.

The command module living area consists of approximately 225 cubic feet of usable space for the astronauts. The three astronauts are positioned in their couches during the high acceleration phases of the mission, i.e., launch and reentry. during the normal portion of the mission, one astronaut can assume a standing position at the work station. The standing astronaut can be attired in shirt sleeves, i.e., without his spacesuit; the other two astronauts located in the couches will remain suited. The astronauts can rotate duty stations as desired. The environment for the astronauts is 100 percent oxygen at 5 psi, which is equivalent to 27,000 feet in pressure altitude, or better than the 3.75 psi of oxygen we breathe at sea level.

The command module is built like a vacuum bottle, i.e., it has an inner compartment which is the pressure vessel and is constructed of aluminum honeycomb material. This aluminum honeycomb pressure vessel is surrounded by a stainless steel honeycomb structure called the heat shield. Insulating material called Q-felt is installed between these structures. The voids between the inner structure and heat shield contain the earth landing system near the top. The reaction control systems and other subsystems are contained near the base of the command module. Ablative material is applied to the outside of the stainless steel heat shield.

The ablative material is applied to the stainless steel heat shield in an asymmetric pattern to match the heat load distribution during reentry into the earth's atmosphere. Maximum aerodynamic heating is at the forward and top leading edge of the command module which is called the aerodynamic stagnation point. Temperature will rise to approximately 5000 F in this area.

The service module provides support services for the spacecraft during the entire mission. It provides oxygen for the environmental control system. The electrical power system is provided by three Pratt & Whitney fuel cells. The service propulsion system provides thrust for maneuvering and velocity changes during the entire mission. This propulsion is acquired through the large rocket engine at the base of the service module. The four reaction control packages on the service module provide pitch, yaw, and roll control for the combined spacecraft configuration, and also small longitudinal changes in velocity. Several antennas for the Apollo spacecraft are located on the service module. Space radiators are installed in the exterior panels of the service module. These provide heating and cooling for the spacecraft systems requiring temperature control.

The service module propulsion system consists of an ablatively cooled liquid rocket engine using hypergolic propellants. The oxidizer is nitrogen tetroxide and the fuel is UDMH (Aerozine 50/50). This engine has 21,500 pounds of thrust and can attain full thrust in 0.5 seconds. Helium tanks are provided for pressurization of the service propulsion system propellant tanks. Four reaction control packages are installed around the service module at 90 degree intervals. Each package has four rocket motor nozzles with 100 pounds thrust total per nozzle. The minimum impulse capability per nozzle is 0.2 pound seconds. This provides fine vernier control for attitude controls in space. The reaction control system control packages also use the hypergolic propellant. Each package is independent of all other systems. No propellant transfer capability is provided. The electrical power is provided by three Pratt & Whitney fuel cells. The cells generate 1500 watts of electrical power. Hydrogen and oxygen is provided from the two liquid oxygen storage tanks and single liquid hydrogen storage tank. The fuel cells consume oxygen and hydrogen to react chemically which generates the electrical power. The only exhaust or by-product of the fuel cells is H_2O or water. This is the astronauts' only source of drinking water during the entire mission. The space radiators utilize water-glycol which is circulated through the thin walled radiator tunnels and provides heating and cooling for temperature control of the service module subsystems as required.

The spacecraft lunar excursion module adapter houses the lunar excursion module during the lunar mission up through translunar injection. For the transposition and docking

maneuver, which is required to provide a proper configuration for the lunar mission, the adapter section is blown apart in four segments using linear shaped charges. These panels fold outward 45 degrees which makes the LEM accessible for the transposition and docking maneuver. The linear charges actually cut the structure.

Two of the three astronauts in the command module will be transferred to the lunar excursion module for a lunar landing. The lunar excursion module is a true spacecraft in that it has no aerodynamic features. It weighs approximately 32,000 pounds and is built in two stages--a descent stage and an ascent stage. The descent engine has a 10,500 pound thrust engine that can be throttled. This engine will provide retro-thrust for the lunar landing. The descent stage is used as a launching platform for the ascent stage during takeoff from the moon for rendezvous with the orbiting command service modules. The ascent stage has a 3,500 pound constant thrust engine that is restartable. Both engines burn the hypergolic propellants. Four sets of reaction controls are mounted on the ascent stage and provide attitude control and small translations for the combined stages or the ascent stage only.

The Saturn V with the Apollo spacecraft is 360 feet tall and weighs 6 million pounds at liftoff. The first stage is the S-IC built by Boeing. It has five North American Aviation, Rocketdyne, F1 engines with 1.5 million pounds of thrust each for a combined thrust of 7.5 million pounds. They burn liquid oxygen and kerosene. This stage weighs 4.8 million pounds of which 4.4 million is propellant. The S-IC burns 150 seconds. The second stage of the Saturn V launch vehicle, or S-II, is built by North American Aviation, Space & Information Systems Division, and has five Rocketdyne J-2 engines with 200,000 pounds of thrust each, or a combined thrust of 1 million pounds. These engines burn liquid oxygen and liquid hydrogen for 395 seconds. The third stage of the Saturn V system is the S-IVB, built by Douglas Aircraft. It uses one Rocketdyne J-2 engine with 200,000 pounds thrust. It ;burns liquid oxygen and liquid nitrogen, and has a gross weight of 257,500 pounds which includes 230,000 pounds of propellant. The S-IVB has a total burn time of 470 seconds, this includes 160 seconds for the first burn which is used for final earth orbital injection, and 310 seconds during the second burn which is used for translunar injection of the Apollo spacecraft.

The instrument unit contains an inertial guidance system for the mission through translunar injection. The Apollo spacecraft is located forward of the instrument unit.

The S-II is 33 feet in diameter and 81.5 feet tall. It has five Rocketdyne J-2 engines with 200,000 pounds each for a combined thrust of 1 million pounds. The burn time is 395 seconds. There are 935,000 pounds of propellant, i.e., liquid oxygen and liquid hydrogen. Liquid hydrogen is 423F and liquid oxygen is -295F.

The Apollo spacecraft with the Saturn V launch vehicle system will be launched into earth orbit from Cape Kennedy, after a total of 12 minutes of burn time. With the third stage still attached, the Apollo spacecraft and the S-IVB will be in a circular coasting orbit around the earth 100 nautical miles high. The Apollo spacecraft must be injected into translunar flight no later than the third orbit around the earth, otherwise the circular orbit will decay and not permit a satisfactory launch to the moon. At a precise time, the S-IVB will be reignited and burned for 310 seconds placing the Apollo spacecraft in translunar flight. One hour later, or approximately 13,000 miles from the center of the earth, the transposition and docking maneuver will be performed, which will provide the proper spacecraft configuration for the translunar coasting flight. The entire trip to the moon will be in coasting flight except for midcourse corrections as necessary. The translunar flight will require about 65 hours or $2\frac{1}{2}$ days. Upon arrival in the vicinity of the moon, the service module propulsion engines will be fired in a retro attitude to establish a circular orbit 80 miles above the moon's surface. The spacecraft will be in the vicinity of the moon one to two days, wherein the excursion module with two astronauts will descend to the moon's surface. After lunar surface exploration, the ascent stage of the lunar excursion module will be launched from the moon's surface and effect a rendezvous with the orbiting command service modules. After rendezvous, the two lunar excursion module astronauts will transfer back to the command module and the ascent stage of the lunar excursion module will be jettisoned and programmed to impact on the moon's surface. The astronauts will then compute their navigational requirements for the trans-earth flight and will reignite the service module engine for transearth injection. The spacecraft will then coast to the earth for approximately three days. Midcourse corrections will be made as necessary. Just prior to entry into the earth's atmosphere, the service module will be separated from the command module. The command module will enter the earth's atmosphere at 36,000 feet per second, or 25,000 miles per hour. The earth landing system will be sequenced beginning at 25,000 feet altitude and lower the command module to the surface of the earth. The entire lunar mission will require approximately seven days.

The ecliptic is the plane established by the apparent path of the sun around the earth. Or it might be considered the plane relationship between the earth and the sun. The earth is inclined 23.5 degrees on its axis and the equatorial plane of course is 23.5 degrees from the ecliptic. The lunar orbital plane varies in angular relationship to the earth equatorial plane in a sinusoidal pattern, over a period of years, with an angle of 18.5 degrees in December 1959 and July 1978. In April 1969 this angle is 28.5 degrees. We might conclude that the moon's movement around the earth creates a constantly changing target for the lunar mission launch.

Certain launch restrictions are imposed for the lunar mission from Cape Kennedy. Launch azimuths are confined between 72 degrees and 108 degrees compass heading from the Cape. There are two possible launch situations every 24 hours, (i.e. the south injection and the north injection). These injection situations are caused by the earth rotating one revolution on its axis each 24 hours. In the south injection situation, the translunar injection would be pointed in a southerly heading in relation to the earth's poles and most of the translunar flight occurring above this plane as it comes into the lunar orbit. The north injection situation would establish the translunar injection in a northerly heading with the translunar flight above the lunar orbital plane coming down towards the moon. In each case, the target for lunar orbital insertion is defined by the earth orbit and translunar orbital plane intersection with the lunar orbital plane. The line of intersection of these two planes will pierce the centers of the earth and moon.

The Apollo spacecraft with the Saturn V launch vehicle will be boosted from Cape Kennedy between the azimuths of 72 degrees and 108 degrees. The translunar injection points are shown by dots and arrows near the earth's equator. These points represent the position of the spacecraft above the surface 100 miles high. It is noted that the injection points move westward 22.5 degrees with each 1.5-hour earth orbit, because the earth rotates 15 degrees on its axis each hour.

The launch restrictions of 72 to 108 degrees create a theoretical launch window of four hours each 12 hour period. However, there are usually only a few launch windows each month because of other factors, which include lunar position in relation to the earth, range, payload, etc. It should be noted that a night launch is undesirable since an abort would create a hazard to the astronauts during darkness hours.

The first stage, or Boeing S-IC, will burn for approximately 150 seconds after liftoff and will be burned out at an altitude of 36 miles. The second stage, the North American Aviation S-II, will ignite shortly thereafter and will burn for 395 seconds or to an altitude of 95 miles. During this S-II burning, the launch escape system will be jettisoned at about 400,000 feet because it would no longer be required for an abort. The third stage, the Douglas S-IVB, will be ignited shortly after S-II burnout and will place the spacecraft with the S-IVB attached into a coasting circular orbit 100 nautical miles high after an S-IVB burn of 160 seconds. Orbit acquisition will occur about 1400 miles down the Atlantic missile range toward Africa.

The Apollo spacecraft with the S-IVB attached will be in a coasting circular orbit 100 nautical miles in altitude. The launch escape system has been jettisoned and the lunar excursion module docking mechanism is exposed at the top of the command module. Attitude control during this portion of the mission is provided through an inertial guidance system located in the instrument section of the S-IVB between the S-IVB and the spacecraft lunar excursion module adapter. This guidance system signals a set of rocket reaction controls located at the base of the S-IVB. This system maintains the earth orbital configuration in an attitude that is tangential to the circular earth orbit. It maintains pitch, yaw, and roll attitude.

At a precise moment, i.e., plus or minus one second in time, the third stage or S-IVB rocket engine is reignited for translunar injection. The engine will burn for 310 seconds accelerating the Apollo/S-IVB from 25,000 feet per second to approximately 36,000 feet per second. The translunar injection window is based upon tracking and communication stations throughout the world. The astronauts will program reignition of the S-IVB based upon these data. About one hour after translunar injection, or 12,800 miles radius from the center of the earth, the transposition and docking maneuver will be performed.

The transposition and docking maneuver is begun by blowing the spacecraft lunar excursion module adapter apart using linear shaped charges to cut the adapter into four segments. These segments will be folded outward 45 degrees. The adapter section being opened will free the command service modules and permit the command service modules to execute a free-flyaround maneuver using the service module reaction control system. The lunar excursion module adapter mechanism on the nose of the command module will be inserted into the top hatch of the lunar excursion module. The command

service modules will then pull the lunar excursion module away from the burned out S-IVB and adapter section. This entire maneuver is executed while the combined command service modules, lunar excursion module, and burned out S-IVB with the adapter section are coasting at a high velocity toward the moon and, of course, without any aerodynamic forces involved.

The combined spacecraft can assume any attitude in space to perform any required task, i.e., midcourse corrections, orientation for better communication with the earth, or orientation to perform a particular navigational observation.

The S-IVB stage, with its 200,000-pound-thrust Rocketdyne J-2 engine, will accelerate the spacecraft from earth orbit to translunar injection velocity, which will be 35,850 feet per second or 99.024 percent of earth escape velocity at 100 nautical miles. Actually, true escape velocity from the earth is not required for translunar flight. The distance from the earth to the moon averages 239,000 miles. This velocity profile represents a coasting flight condition. Course corrections are not used to change the basic velocity profile, but to provide proper correction in course to arrive at a point adjacent to and 80 miles above the moon's surface. At a point about 200,000 nautical miles from the earth, or 39,000 nautical miles from the moon, the spacecraft will be acquired in the moon's gravitational influence and its velocity will increase during the remaining trip to the moon. Velocity at a perilune arrival will be 8,400 feet per second.

From translunar injection to reentry into the earth's atmosphere after the mission is completed, the entire mission is conducted in a coasting flight situation except during periods of delta V or change in velocity as required to execute the mission. The delta V or change in velocity of the spacecraft are primarily executed by use of the service module propulsion engine. The total burn time to execute all of the delta V maneuvers is about ten minutes. They may be categorized into four major areas; i.e., midcourse corrections during translunar flight, lunar orbit insertion, or retro upon arrival at the moon, lunar orbital rendezvous to assist in rendezvousing with the ascending lunar excursion module, transearth injection, and midcourse corrections during transearth flight. Approximate delta V values for typical mission maneuvers are:

lunar orbit insertion	3,000 feet per second
lunar orbital rendezvous	650 feet per second
transearth injection	3,600 feet per second

The proposed lunar landing area for the lunar excursion module is in the equatorial area of the moon as we see it from the earth and covers an area five degrees north and south of the lunar equator and 40 degrees east and west of the center of the moon as we view it.

The command service modules with the lunar excursion module execute a 180-degree maneuver to assume a retro-thrust attitude. At a very precise point, the service module engine will be fired for a total duration of five minutes to establish lunar orbit 80 miles above the moon's surface for an orbital velocity of 5,280 feet per second. The orbital period at this altitude and speed is two hours. The astronauts after two orbits will have determined their trajectory over the moon's surface, determined their intended landing, and transferred two astronauts to the lunar excursion module for checkout of the module. At a precise point on the dark side of the moon, the lunar excursion module will detach from the command service modules, translate laterally or downward, and initiate retro-thrust firing of the lunar excursion module descent engine to establish a delta V of 97 feet per second. The lunar excursion module retro-thrust will be fired tangential to the orbital trajectory and will place the lunar excursion module in a coasting decaying orbit such that the module will touch down one hour or 180 degrees later on the moon's surface. This 180-degree descent is called a Hohmann transfer or minimum energy transfer and is typical of space rendezvous in order to burn a minimum of propellant.

The command service modules, with one astronaut, will continue to orbit the moon at 80 miles' altitude. The lunar excursion module will approach the moon's surface in a very flat trajectory, firing its descent engine for a total of 7.7 minutes prior to touchdown or landing in a vertical attitude. The final letdown phase during the retro-thrust is a very flat trajectory requiring 200 nautical miles distance over the moon's surface to descend the last 50,000 feet.

After lunar exploration by the lunar excursion module astronauts, the ascent stage will be launched using the descent stage as a launching platform. The launch will be coordinated with the orbiting command service modules. The lunar excursion module launch will occur when the command and service modules are directly over the lunar excursion module. The lunar excursion module ascent trajectory will be very flat and will require 140 nautical miles to ascend the first 50,000 feet. Burn time for the ascent engine, which generates 3,500 pounds of thrust, is five minutes.

The lunar excursion module ascent stage goes into a coasting ascent after the five-minute burn during lift-off. It will coast to a position 165 degrees around the moon or 55 minutes in time passing the orbiting command service modules. The ascent stage will assume a position above and ahead of the command service modules. The lunar excursion module ascent stage will then initiate small delta V retro-thrust firings to effect a rendezvous with the command service modules. This rendezvous occurs on the dark side of the moon.

The lunar excursion module ascent stage will be disconnected and programmed to retro-fire and impact on the moon's surface so it will not remain in permanent orbit around the moon as orbital debris.

The astronauts will require at least two lunar orbits to determine their navigational requirements for their transearth trip.

Based upon on-board navigational information and information from the deep space information facilities on earth, the astronauts will reignite the service module engine and accelerate to transearth injection velocity. Service module engine burning for this maneuver is about 3.5 minutes. During transearth coasting flight, midcourse corrections will be made as necessary to arrive at the proper entry corridor on earth. The service module will be separated only a few minutes prior to reentry into the earth's atmosphere. Transearth flight will be between 72 and 80 hours duration.

The command service modules must be on a trajectory that will place them into the required entry corridor which is defined by angles between 5.5 degrees and 7.7 degrees tangent to the earth's atmosphere, which is considered to begin at 400,000 feet in altitude above the earth's surface. After the command service module will be separated and the command module will assume the proper attitude for reentry into the earth's atmosphere at 36,000 feet per second.

The center of gravity of the command module is purposely offset from the longitudinal axis of the command module. This center of gravity offset provides the command module with a Lift/Drag value of 0.3. This L/D will prevail during the entire reentry flight unless the command module is rolled with its rocket motor reaction control system to change the lift vector to a lateral or inverted attitude. The lift can be deleted to zero by rolling the command module 90 degrees or provide negative lift by rolling the command module to an inverted attitude. Rolling the command module 90 degrees

would displace the flight path laterally; therefore, if a zero-lift condition is desired, the command module can be rolled alternately left and right in order to maintain zero lift with no lateral change in flight path. Aerodynamic heating will be at a maximum at the upper leading edge or stagnation point of the command module during the reentry. Temperatures in this area will rise to 5000 F.

The command module will touch down on the earth's surface 2,500 nautical miles from the atmospheric entry point or 400,000 feet with a L/D of 0.3. If the astronauts desire to depress their trajectory and touch down on the earth's surface sooner, they may roll the command module inverted and depress their trajectory such that they will touch down on the earth's surface 1,500 nautical miles from the entry point. The footprint for touch down permitted by the maneuverability of the command module during the aerodynamic reentry phase can be defined as 100 miles in length or 50 miles laterally left and right at the shorter range of 1,500 nautical miles or 200 miles laterally left or right at the extreme range of 2,500 nautical miles.

The command module will have a velocity of MACH 0.3 at 25,000 feet altitude from the aerodynamic drag characteristics of the command module. At 25,000 feet, the forward heat shield will be jettisoned. After a three second time delay, the drogue chutes will be mortar deployed. The drogue chutes will be released and the pilot chute will be mortar deployed at 15,000 feet. The pilot chute will extract the main parachutes which will be deployed to a reefed condition at 13,500 feet. The main parachutes will be fully opened after being reefed for six seconds. The three main parachutes will lower the command module to the earth's surface at a velocity of 23 feet per second.

Many months of ground and flight tests will be required for development of those flight techniques required to execute a manned lunar landing mission. Flight categories include such tests as abort and recovery, test flight using instrumented test vehicles, and booster spacecraft test vehicle flights into suborbit and earth orbital flights. Early in 1966, the first Apollo spacecraft will be flown unmanned in a sub-orbital flight to qualify spacecraft subsystems including demonstrating heat shield integrity. After two suborbital flights, unmanned in 1966, the first manned Apollo spacecraft flight will be performed later in 1966 for an earth orbital mission of three astronauts for one week duration. Manned earth orbital flights will continue with the lunar excursion

module to demonstrate rendezvous and docking techniques and elliptical earth orbital flights will be made to demonstrate other flight techniques including navigation, etc. The sub-orbital flights and early earth orbital flights will use the S-IB launch vehicle and later flights will be conducted using the Saturn V launch vehicle which is required for the lunar mission. The manned lunar landing mission will be accomplished before 1970.

Ten satisfactory flights have been conducted with the Saturn I launch vehicle system. This system has the ability to place 20.2 thousand pounds into earth orbit 100 nautical miles in altitude. Only Apollo instrumented test vehicles were flown with the Saturn I system. The first actual Apollo spacecraft will be flown with the S-IB launch vehicle which has the ability to place 33,500 pounds into earth orbit 100 nautical miles in altitude. The first Apollo manned flights will be made with this launch vehicle system. Later Apollo flights will be conducted using the Saturn V which will also be used for the manned lunar landing mission. The Saturn V with the Apollo spacecraft weighs 6.0 million pounds at liftoff. The Saturn V has the ability to place 250,000 pounds in earth orbit 100 nautical miles high or send 94,000 pounds to the moon.

of a technological race, I don't care if it is to the moon or coming up with better medical systems and drugs or anything else. I don't think the United States wants to be second in anything. We have the gross national product, and the pulp and various other ingredients to be a world leader in all functions. I firmly believe this. You might say, "why are we going to the moon?" Well, in the first place because it is there. In fact, I could give you many examples. For instance, Daniel Webster, who was a very learned man, said at one time when he held a government position that he wouldn't contribute one nickel to set up a transatlantic line to the west coast because it was a barren and infertile land that was worthless. All I have to say is that we have done pretty well out here. Now I am not saying that we are going to set up another Los Angeles on the moon, but the idea is that how can we say what it will give us when we do get there. I firmly feel that if we go to the moon and find nothing but a bunch of useless rocks, 99.9% or even greater, of what we have done to get to the moon is going to be beneficial to mankind.

Question: Do spacecraft become obsolete?

Mr. Long: As you know, John Glenn on his first earth orbital flight had some flight problems in that he used up too much fuel and he almost didn't have enough to re-enter the atmosphere properly. In four flights, earth orbital flights of the Mercury, we completely exploited the flight envelope capabilities of the Mercury. In other words, there was no reserve in our Mercury flights. What are we

P A N E L

MAN REACHES FOR THE MOON

by

B. Jack Long

Question: Are we in a space race with the Russians?

Mr. Long: That is usually a standard question. We, at North American, are not in a space race with the Russians. We are only executing an aerospace contract that is defined by National Aeronautics and Space Administration. In fact, we know nothing more about what the Russians are doing than we read in Aviation Week or we read in the Los Angeles Times or any other publication. However, as I say we are dedicated and contractly required to adhere to the schedule that has been laid down by NASA.

I feel sure that the United States cannot afford to be second in any kind of a techological race. I don't care if it is to the moon or coming up with better medical systems and drugs or anything else. I don't think the United States wants to be second in anything. We have the gross national product, and the pride and various other ingredients to be a world leader in all functions. I firmly believe this. You might say, "Why are we going to the moon?" Well, in the first place because it is there. In fact, I could give you many examples. For instance, Daniel Webster, who was a very learned man, said at one time when he held a government position that he wouldn't contribute one nickel to set up a stagecoach line to the west coast because it was a barren and infested land that was worthless. All I have to say is that we have done pretty well out here. Now I am not saying that we are going to set up another Los Angeles on the moon, but the idea is that how can we say what it will give us when we do get there. I firmly feel that if we go to the moon and find nothing but a bunch of useless rocks, 99.9% or even greater, of what we have done to get to the moon is going to be beneficial to mankind.

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saying? That man is getting pretty smart in his systems? We completely exploited and made obsolete a space craft in four flights. Now we are not going to make any Gemini obsolete in four flights, in fact we are going to make use of it for quite some time. Actually, we are at the point now where we have a great degree of reliability and also we have established a tremendous learning curve. Now that points up one thing; when man really tries to do something, he can.

Question: I am impressed by the number of sub-contractors whose individual reliability factors will make this near perfect total. The church, including our church in the southern area, is not notable for its reliability factors in a common project. As you have "successfully" begun to complete a project with near perfect reliability, with all of these different sub-groups, persons, contractors and scientists, what insights could you offer us on how all of these groups, persons, projects have worked together to this successful end?

Mr. Long: Time didn't permit in my briefing today to show you an organizational chart. The National Aeronautics and Space Administration are the program managers of our space program. We are just one of the prime contractors. However, that doesn't mean that we don't have certain systems responsibility, that is working with the other contractors. There is one quality in man that as far as I know has never been detectable in any battery of tests that you can give him. That is motivation. That is a very important ingredient. You've got to want to do something if you are going to succeed. Most of the people that I know that work in the aerospace program are not just working for the almighty dollar. We work because that is what we want to do. This gets into a kind of philosophy. The philosophy is that we want to do this!

Now the other thing you were talking about is reliability. It's like believing in anything. We get to the point where we won't even accept the idea of having failures. Now, that doesn't mean that we are not going to have failures. But we have to believe and work toward 100% reliability in all systems. I showed you today a spacecraft that has one engine. Now that spacecraft is only going to make one flight. It's like building a DC 8 and putting one engine on it and doing nothing but testing it on the ground, and on its first flight (it isn't a test flight) you are going to fill it up with people and fly it across the North Pole to Europe. How would you like that? Well, that's what we are working for. We are working for 100% reliability and when you've got dedication and stringent requirements and specifications, you can get a job done.

Question: How about the spacecraft itself? The men in it? The psychological factors?

Mr. Long: Well, as far as I am concerned the astronauts are about the greatest bunch of fellows I've ever known in my life. They

have this motivation and complete dedication. I have the technical requirements for being an astronaut, but I'll tell you one reason why I don't want to be an astronaut. It is not because I don't want to fly the mission, but I just don't want to work that hard. It's unbelievable the amount of time and energy and effort that the astronauts put into training for a mission. Learning the spacecraft, they sacrifice a great deal of time being away from their families. As far as their psychological attitude toward the mission, they are all test pilots, or the equivalent of test pilots, and they face far more dangers and less reliability on systems that they have flown in the past. I have flown myself on many test programs and I have never seen the reliability and effort put into manned aircraft system, particularly military aircraft, that prior to testing are being flown, that I have seen put into spacecraft. Here again it goes back to the basic thing. We're trying harder on the system and we are getting better results.

Question: Here are two questions on the fuel. What is the possibility of solid fuel? The other is, what is this doing to the earth's atmosphere?

Mr. Long: The affect on the earth's atmosphere isn't a drop in the ocean. In other words, it's just insignificant and is not worth mentioning. As far as the solid propellant, we use solid propellents in some of the smaller systems. For instance, the launch escape systems are solid propellents. Solid propellents are rather difficult to handle if nothing else than size and weight. Also they are a little delicate in that they have to be completely homogenous. There can be no cracks in the core. When you are putting one on a road or where there is a railroad, if you crack the core, you have the potential of an explosion. Now if you take a booster that weighs as much as our liquid first stage, (4,800,000 pounds) you aren't going to have too much luck moving that thing around. What we do, we assemble this thing in a vertical position and then pump the propellant into it. In other words, it becomes purely a logistic problem. Another reason why we haven't used the solid propellents in this country is because of the structural integrity of the solid grain propellant itself. But please understand in many cases in certain applications, solid propellant motors for military systems and possibly space systems have their advantages over the liquid. I only wanted to point out the difference.

Question: There is a question here concerning the Russians. Do they use different fuel or are their boosters simply larger?

Mr. Long: I spent quite a bit of time at the Paris Air Show in June, 1965, reviewing the Russian spacecraft on exhibit there and also talking with a number of Russian lecturers. I can say this about the Russians systems in two words - simple and effective. Now I'm not casting any reflection on our program at all, in fact I like our program better, but I'm just saying theirs is simple and effective. For instance

on their Volstok spacecraft, their single manned spacecraft, they use a sphere. It looks like a great big iron ball. They don't care about weight because in the past they have not been boost limited as we have. Like in the Mercury system, they had bigger boosters. You want to know why they had bigger boosters? Because, they got to the Von Braun gang before we did, and started doing something with them. That's putting it bluntly but it is true. They don't have many comforts for the astronauts. I'm not saying that we are pampering our astronauts, because as far as I am concerned the efficiency of an astronaut is directly related to his comfort, and don't you think that they aren't uncomfortable up there for a week. In fact, Pete Conrad has advocated that they not use space suits. In fact on some of their later flights, if I might use the expression here, they are going to fly in their "long handle drawers". The Russian system, for instance, doesn't attempt to maintain attitude during earth orbital missions. They let it tumble freely. Also, when they get ready to orient the spacecraft for a re-entry, they use compressed air. That is about as simple as they can get. I still prefer our system. I am saying that the Russians have done an excellent job using very simple and very effective systems.

Question: In respect to primary purposes and goals of the Apollo Mission, is there any point in which the mission may be aborted and still achieve some of the purposes that are secondary to actually reaching the moon?

Mr. Long: We do not plan just one mission to the moon. We are not going to say, 'all right we've been to the moon, now we're going to shut down Cape Kennedy, and this sort of thing.' In fact, right now there is a program to look at 24 additional missions beyond the basic lunar landing program. This includes earth orbital missions and lunar support missions. This is called Apollo Applications. Up until three months ago it had a program title of Apollo Extension Systems, AES. We hope to gain something from each mission. We will add to our learning in the flying time. What we need right now is plain old flying time in space to learn. Up until recently, the Russians were ahead of us, but we are ahead now. If there is someone here who has never driven a car, you will know that you can read all the books in the world about driving a car, but until you get out and drive that car, you're not going to have the operational experience. We need operational experience. On every mission, even if you only accomplish 50% of the task, you are going to learn so many things that you won't have to learn on the next mission. With the 50% of the time that you gain on that one, you can apply new things on the next one.

Question: There are two questions here. One says that in the U.S. News in World Report an eminent scientist said in an interview that the lunar mission is doomed to failure. The second one asks you to elaborate on the problems involved in the rendezvous of two spacecraft.

Mr. Long: For those people who have read the article, the charts and slides that the fellow used were about three and four years

old. If I said I could give you a negative briefing, I could sit and show you in this briefing lots of things that could happen on this mission. I could also stand here and tell you how many times you could get killed between now and the time you get home and what all the possibilities were....I could scare you to death! You wouldn't even leave this room.

I read the article completely and my attitude is like the old turtle, you've got to stick your neck out to get ahead. Now that doesn't mean you stick it way out, you stick it out a little at a time. I don't agree with the author. I've spent my entire life operating high performance systems myself and if I believed his philosophy, I would never have gotten into the airplane the first time. I'd be afraid the wing would fall off. I'm not casting any adverse remarks about this gentleman, but I don't think the fellow has been getting the proper information. I just got through talking with scientists and engineers all over Europe. I don't think anyone has a monopoly on brains, but we have learned a great deal here. I just wish the fellow could come over and see what is going on.

The problem of rendezvousing in space. It is like anything else. You learn to fly a particular machine. The reason that they use military pilots as astronauts is because once you step from one airplane into a new type of airplane, the controls react a little differently, the mass of the aircraft is a little different, the flight characteristics are a little bit different. Now, what the astronauts are doing, they take all this skill and ability and knowledge that they have learned flying earth bound flying machines (by earth bound, I mean atmosphere and air breathing systems) and apply it to a spacecraft. After a very little bit of exposure to this they acquire a great deal of skill. Once the astronauts have the opportunity they will understand those manual skills and dexterities required in order to rendezvous with a spacecraft. Now obviously some of this is done with computers. In fact what happens is that the earth will track both spacecrafts. They will determine the separation between the two. They actually compute the rocket motor firing time required in order to effect a rendezvous. But ~~once~~ you get close it's no different from effecting an inflight refueling (like in The Strategic Air Command, where they refuel fighters). It still comes down to the manual control and the pilots are going to do it. It is just a matter of time and of demonstrating it. The bigger the system is, the more difficult it is because the greater the mass. It is just like trying to operate a big trailer truck on the freeway compared with a Volkswagon. That's the best analogy I can think of. That is one reason we went to the lunar orbital rendezvous technique because we can rendezvous with smaller systems. The Russians are apparently going to the earth orbital rendezvous technique. They will have to rendezvous with some very large tankers. Right now I couldn't get real excited over trying to rendezvous with a big tanker that weighs about a million pounds. You'd have to touch it real lightly.

INTRODUCTION

for

Dr. George M. Petrie

The first speaker of the afternoon entered the field of data processing in 1950....so he is truly an "old timer" in his field considering the first real computer was not developed until the later part of the 40's.

In his work with IBM, he has been involved in programming of computer applications. But his concerns have also included the fields of marketing, product development, research and education. Most recently he was involved in computer assisted instruction.

There is an interesting story about his coming. I had originally been in communication with Mr. Thomas Watson, Chairman of the Board of IBM, who had suggested Dr. Given, Director of Los Angeles Systems Development Laboratory of IBM, who originally agreed to speak. Then something very interesting, and I believe unusual, (and I hope a sign of things to come); our speaker transferred part time over to 475 Riverside Drive with the National Council of Churches, (Department of Church and Economic Life), to work with them on projects having to do with human values in a society of advancing technology; wherein the NCC seeks to determine the needs of our society which should be met by the church. So his support is from both the church and IBM!

Dr. Given suggested that our speaker was really the best man for the job since this was now his new corporate assignment. We telephoned him and received an immediate and enthusiastic "yes". He flew all the way out from New York City last night and will review for us the world of Computers, speaking on "What is a Computer"?

Staff Consultant to National Council of Churches from IBM,
Dr. George W. Petrie.....

Now in talking about a computer, first of all a computer is a device that gets jobs performed. Second, it is a device that performs routine mental tasks of man. Third, it is an extension of man and fourth, it is a tool which permits cybernation. And number five, I want to talk about it being a device which can become a focus of ethical concern in our society. Let us go back to my first point.

A computer is a device that gets jobs performed. Its function is one of increasing productivity, otherwise, we would have no reason to want

WHAT IS A COMPUTER?

by

Dr. George W. Petrie

Coming out in the plane last night, I conjectured what your approach might be if the topic, instead of being "What is a Computer?", would be "What is a Church?" and I could reminisce a bit and suggest that many of you might say different things. I suppose as a layman, if trying to cover that topic, I would want to stress a number of points, such as the church is an organization that meets human need. It is a center that helps men relate to God and its extension of God into the community. It is an influence to remake man. It is an agency to give insight into ethical judgment. These were the first five that came to mind and I suppose you have already downgraded me two points for not thinking of something obvious that I missed.

But I, too, want to try to talk about what a computer is and make five points. I would like to call to your attention that when I define a church I do not refer at all to wood and stone and glass and steel, the components that go into the physical structure. I think many times one could understand quite effectively that which makes a good church without being expert at all on architecture.

Similarly this afternoon as we talk about computers, I am not going into the components that make up these fanciful devices and if I have an apology whatever for showing you that background film (which incidently I have seen a dozen times and I saw some new things this time I had never seen before) I want to hurry and see it again. In this film I will make only one qualification. It was made a number of years ago and all of the components that you saw there are completely outmoded and passé at this time, so if you would look at a computer today there isn't one thing inside a computer today that would look like what was there except a cable that ran from one device to another! That is about the same. I pointed out that we did not talk about components, we talked about people in connection with the church.

Now in talking about a computer, first of all a computer is a device that gets jobs performed. Second, it is a device that performs routine mental tasks of man. Third, it is an extension of man and fourth, it is a tool which permits cybernation. And number five, I want to talk about it being a device which can become a focus of ethical concern in our society. Let me go back to my first point.

A computer is a device that gets jobs performed. Its function is one of increasing productivity, otherwise, we would have no reason to want

to use it. As a matter of fact, if we review the purpose of any type of mechanization, we invariably find that it is done as a result of management, corporations, individuals trying to increase their productivity.

Why do they want to increase productivity? They want to do it in order to get unit cost down, to be competitive with other firms likewise bringing down unit cost. In the United States, we are not increasing our productivity fast enough and some of the very countries that we helped, (Germany and Japan), after World War II have rebuilt plants that are much more efficient than ours in some ways, much more productive than ours, wherein unit cost is lower. Thus, we want to be able to increase our productivity and the computer is one of the tools that permits that sort of thing. I could state many examples, but I want to skim through only a few. I shall mention some things that are being done today and a little bit about the future. If I mix the two together, I'll try to make distinct what I mean.

Take the world of banking. Ten years ago data processing was a necessary nuisance in a bank. Today it is an essential part of modern banking operation. As a matter of fact, one gentleman has said that the best place to learn about modern banking is in the data processing section. In case you missed Business Week on Saturday, you might be interested in a completely new venture and experiment being tried by the banks in the state of Delaware. They are exploring the possibility of issuing charge cards through their checking accounts in which a person can take into a merchant's office, present this card which is put into a telephone device and the person's bank account is debited the amount of the goods purchased. It replaces cash. You may go into the next store and the same thing happen again. All the purchases will immediately be debited to your checking account by that particular amount. Similarly the experiment goes into the office of the employer, who, on pay day, simply transmits by telephone to the bank the amount to be credited to the person's checking account. At the end of the month, the bank would issue each person a statement telling what went into his account, what was drawn out of his account, what the balance is, without the individual writing any piece of paper whatever. It is currently on an experimental basis. You can see that it has vast implication, even some repercussions with those who have a vested interest in the credit card business. As an experiment, it is a way in which society may move forward to a better way of doing things. It may also bring in some problems and like any other advance must be looked upon in that particular fashion.

In the field of farming, computers are being used to reduce costs. The computer has invaded the barnyard. Experts prophesy even more astounding revolutions in farming in the near future. A number of states have facilities in which farmers may discuss with local banks their need to help them in planning their particular work. It is forecast that some day isotopes may be injected into plants to signal to a computer when it is time to add more water or fertilizer.

In marketing, I think it is common place that computers are being used to predict what the outcome of the market will be and to help a business actually see what its possible market is in response to the offering of a new product on the scene. In manufacturing, there are now what are called blue-color computers that can actually run components of the plant. Likewise, industrial process control is something that has been in operation for a number of years.

I happened to be on the fifth floor and saw the lights flicker out in the recent blackout of the New York area. It is far easier for me to believe that it didn't happen than to actually give voice to what I actually saw. I find it completely contrary to my ordinary experience. Later, riding in my automobile listening to the car radio, I heard that the entire state of Massachusetts was blacked out. I wondered how could this happen in America today. My own feeling is that this is probably the most fortunate thing that we have had happen in years in revealing to us some of the complexities of some of our own organizations. It not only takes place in an electrical power network, it takes place in the corporation which, as it grows, runs into tremendous communication difficulties. I have reason to think that it may even occur in some large church organization. I am certain that it occurs in a large organization that seeks to serve the needs of some 31 of the Protestant and Orthodox churches (The National Council of Churches). Here communication is found very difficult and sociologists and others must give extreme attention to some of our problems of organization.

There are many things that we will learn from this power network, not the least of which was friendliness. It was amazing what happened in Manhattan last Wednesday morning. As a matter of fact, those of you who may anticipate that working in an inter-church center would somehow give you an environment with much more warmth than you would have in other buildings in the New York area, would not only be astounded, but confounded by the lack of this sort of thing. Large groups of people not connected together with the same purpose are much the same whether they are at the inter-church center, whether they are at the Rockefeller Building or the Chrysler Building or any other place.

On that memorable Wednesday morning, I went into the hallway to get a drink of water. I passed five people each one of whom I had not known before and whom I had passed previously (at least a dozen times), on this particular morning, smiled and spoke a good morning. Why? Because the New York area had gone through a sharing experience.

Another avocation that I could talk about (not quite as vital as some of these more typical business sort of things) is in the playing of games, chess and checkers. Now, I am not certain that the use of a computer to play chess or checkers adds tremendously to our gross national product in any one year, but it does teach us something concerning strategy that the computer should use and indeed programmed so that the experience would be used to feed back and help the machine

select or reject alternative strategies. If you follow what I am saying, you realize that experience, then, is the factor which is used to teach the computer how it should behave and this being the case, it was found that it took about 20 games of checkers for the computer to be able to play a sufficiently sophisticated game, that it had more than a 50-50 chance of beating the man who had taught it the game to begin with. This has some implications as to what a huge aggregate or organization can do in actually learning to better its own performance. The same thing could be said about the game of chess which as many of you know, is much more complicated than checkers. Are you interested in what computers can do to help enforce the law? Recently, 86 persons were indicted in a bookie inquiry and computers were given a very strong nod and vote of thanks for an assist because they were able to process records in sufficient time to avoid the three statute of limitations which might well have come in and cut off the operation.

What I am trying to say is that with a computer you have a new tool and the possible formation of a new world. If we look as to what the computer is going to do in tomorrow's horizons, I think that we meet an almost unlimited challenge to our imagination. These devices will be able to recognize voices, faces, symbols. They will be able to process analogies to logic. They will be able to learn through experience. It is even possible that at the end of the century, perhaps it will not be a Russian or a Cuban or an American who is the world's champion. It may very well be a computer. They may give us access to information in libraries at a time interval much quicker than anything what is known today. In the field of medicine, the ability to diagnose disease is one that comes to be of increased complexity. There are so many diseases. Oh, it's true the common cold and dandruff and an ingrown toenail can be picked up pretty well. But when it come to the more complicated things, doctors could actually go in and narrow it down. The trouble is that many of the tests are destructive and the point is you want to see what you can do in order to not only diagnose this disease but to help the patient recover. Computers may very well help in the future to reveal to the doctor in a quick way what additional steps are necessary, what additional possibilities must be coped with. A computer is a device that get jobs performed.

I think our little film brought to mind that a computer can be used for simulation. You remember in the chemical process industry, the computer would simulate what takes place in the plant. Simulation today is of exceeding importance. Now in order to talk about a device that performs routine mental tasks of man, I want to have your participation. I want to perform a little experiment. I have put a blackboard on my right and using your imagination let's think of another blackboard on my left both having the same configuration upon them. Suppose it represents the contents of a room. A room that is closed off. It is a room that has a bookshelf, a fairly extensive library which would include, of course, the encyclopedias Britannica, year books of all kinds. It would also have procedure books so that

you would ask how to make out this particular return for my sales tax in the state of Minnesota. The man could pull out a book, look at the procedure, review the rules, and for any given data he would be able to work your problem. So on this shelf we have access to facts and procedures. These symbols are merely symbols that try to give meaning to the word facts and procedures. Remember that now. On the side we have an electric typewriter. This electric typewriter is hooked to another electric typewriter so they synchronize together. The other one is outside the room. This one is inside the room. A pad of paper is here where a person can do scratch work while making out a tax return. He can do his doodling and figuring here and then type the answers on a nice return. He can use a desk calculator so that he can punch buttons on that, check his work, make sure that his arithmetic is correct. We also have a man in the room. This man is able to work on this typewriter and he is able to work on his scratch paper or on his desk calculator. He can look at any book and he is a fairly well versed man. Suppose you then find a typewriter that is outside the room that does anything you wish by way of asking it a question. However, you ought to rule out questions that involve ethical value. For instance, don't ask it questions that have bias. Should we give more money to the synagogue or the symphony orchestra? This is a matter of value judgment and let's not try to ask questions like that. Instead, ask questions that have factual answers. If you want to ask him a question like "Which is the worst crime, kidnapping or manslaughter?" He could look in a book and say, "Well, kidnapping has such and such a penalty attached and manslaughter such and such and hence society seems to attach greater moral value to the one than to the other." On the blackboard over there instead of there being a man, there is a computer. You see this man monitors or controls the flow of information between the facts and procedures where he types out what is there. He has a performance control function. In the other room there is the very same thing, except instead of a man being there, there is a computer. Instead of the facts and procedures being in books, they are stored in magnetic tapes and other forms that the computer can quickly get access to. The desk calculator is indeed an internal part of the computer that does arithmetic at a pretty fair rate, I might add. The scratch paper is erasible memory which is there and which is part of the way the computer is organized and of course, the output is on the printer. (Incidentally, I apologize for that printer you saw over there which only would do 150 lines a minute. Now you can have whatever speed you want.) Well, now the experiment is this. What sort of a question will you ask in order to try to sort out whether it is the man that is in the room or the computer? You come out and you want to type something on there and see if by raising a real provoking question you can determine from the response whether it is man that is in that room or the computer?

Who has a question? What is the color of your hair? Well, you ask that of the man who is there and he states the answer is, white. Now, the question then is, over here in this room with the computer, could we have organized information so that the computer could perform the task of giving information the way the man has done? In our personnel records of the organization, can we put in information like color of

hair so that we can immediately call out that particular fact to identify a person? The answer is yes. We have that sort of information. It has been prepared beforehand so that it becomes part of the factual information that the computer can refer to. In both cases you get the answer.

What is the next question? What is the population of the 10th largest city of the world. Now if we think in terms of how the man will do this it would be a long detailed process of maps and searching and comparing. Is this the sort of task a computer can do? Yes, a computer can have access to the information in regard to the population of cities, can actually search out, can actually seek out, and sort these and if you wish actually give the list of ten cities sorted in order of increasing population.

Examine this question; In organizing an anti-poverty program, would it be more efficient to include representatives of the poor or not? Now there is a question that gets a little bit beyond where we are. In organizing an anti-poverty program, is it more efficient to include in the management team members of the person who are in the locale or is it more efficient not to do this? Let's consider how the man answers this question. What information does the man need to answer this? He needs to know something about the contribution of the leaders from among the poor who can contribute to this program. He could do this by getting experience studies of which there is all too little today, if I am correctly informed. The other would be to collate sociological information which could be very dangerous. The man researching your problem would find himself up against a difficult sort of thing. What about the computer? The computer could not do any more than to manipulate the very same data that is open to man and I would suspect, a little bit pessimistically, that in both cases you would get an answer which is less than satisfactory.

Next question. What will be the rainfall in Southern California next year? Now for the man to project this, he will naturally pull out the weather records, going back perhaps a hundred years and from that information he can, with his calculator and his paper, try to say what the average rainfall is, and what the variance is and then give a reply that on the average you would expect to get .03 inches per year, plus or minus perhaps .01. We must realize that the same thing can be done with a computer and indeed the weather bureau does have that mechanized right now so that you can ask that question and the answer comes back very, very quickly.

Here is another question. Who wrote the Merchant of Venice? A good question. Who wrote the Merchant of Venice? What does the man do? He reaches back here. One volume, of course, is the volume of Shakespeare and he looks in the table of contents and finally finds Merchant of Venice. Wait a minute. I'm making a bad assumption. He may know that the Merchant of Venice was probably written by somebody like Shakespeare and hunts and confirms it or he may not know. In which case he'll have to get some sort of an index as far as titles of great

plays and that sort of a thing and look it up. So depending upon the man's educational back ground, he may deduce the answer quickly or he looks through a number of different sources before being able to reply. The same information to which he has access I think obviously the computer can have access to also, and that what we are saying is, that facts and procedures which are available to man are available to the computer.

Perhaps we ought to think in terms of more tricky questions. "What size of manpower force is necessary in South Viet Nam to win the war?" Would you agree with me that this is a sort of question in which you must assess the factual information which is available, in this case to military leaders and, in general, not to the civilian segment of our population and one must use the procedures which are the doctrines of the military in attacking this type of problem. The man (in our room), if he has some military training is perhaps more apt to be able to proceed with this type of problem and also to say what the degree of certainty is and that whatever method he uses can also be used by the computer.

"What is the most profitable transportation mode in a city like Los Angeles?" Now, this does get us into a little bit more elaborate factual evaluation. What is the most profitable transportation mode becomes quite a difficult problem in city planning. In the first place, one must know the facts to be able to deal with the large metropolitan area and indeed facts, I believe city planners would say, are very difficult to obtain and beyond the fact one needs to know something about the trends so as to predict what different elements of the city will look like in the future. Then one must have access to information from technology to be able to state what are the feasible transportation systems that one should consider, underground, above ground and so on, helicopter, rockets and goodness knows what. From all of these one must try to make an evaluation in regard to optimisation and here there are some very difficult problems for the operations research analyst in trying to make the trade off of putting all of the different criteria so that they may be reduced to a common denominator. Cost factor of the system is funding, but the human factor of noise that may arise from this city as a disagreeable element of environment and how much noise can one withstand in order to be able to cope with the situation is moot. What is the probable effect upon the population. These must also be translated to a common value of utility. It is an exceedingly difficult problem. The man would take well over a half an hour to work it. The way that he "massages" the problem, the methods of operation research that are used to attack this could also be done by computers.

Let's have some other type. "Is it morally right to drop a hydrogen bomb on North Viet Nam?" Now, when you ask a question is it morally right, I agree to come back to this at the end of my discussion, but here you are getting into a value question which is somewhat like that

one that I raised about whether it is better to give money to the synogogue or the Symphony orchestra and here you have some value judgment and I think the man himself is going to disqualify himself and say I am not able to give you an objective answer. He'll tend to give you an answer which engenders his own belief and outlook.

"What will be the population of Long Beach in 1980?" A specimen of the trend information from census bureau would help to establish a base, a search of any other information that a regional planning committee would have, such as, a plan to cut Long Beach in two with an arterial highway could ruin the town. That sort of thing would have an affect here, all of which could in some way be weighed by the methods that are opened to city planning so the man could come up with a projection and so could a computer.

"What commodity is most in demand in the world and what would the cost of production and transportation be and what profits would I expect?" These are the problems that a market planner must look into and are the sort of things that you do take information that is available and you put it together, you process all this country by country, add it up, you try to program what you may do by means of a capital investment program and extrapolate what your costs are going to be. I think these are all a combination of conventional things.

Suppose somebody outside, types a pattern on a piece of paper of a row of dots that are in a straight line and then asks the typewriter what it is. See, this would be a different sort of thing. Can man, looking at the records here, see a pattern of dots in a straight line and give answers to the questions that has come to him? What is this? Can you see it typed out in front of you? What do you say? Points on a straight line. What are you doing there? You're not looking for factual information but you are recognizing a pattern, are you not? Computers can be programmed to recognize patterns, a different type of task.

"What subject should I preach on next Sunday?" One answer you may get from the man is, "How should I know, I'm not a member of your church." I'm afraid the man could flub this very badly. If he would answer it, you would like him to give you because of his personal need, would it not? You really would like a warmly human contact on this question, which I think is a little bit outside of the field of processing data in the sense that I mentioned.

"Would programs put into the computers give answers to these value judgments, that is, can you get philosophical replies by leaders in various fields printed out in short form that would then help you to make a value judgment?" A very good question and I want to turn it around just a little bit. Here we are touching on something that could be a little bit dangerous. Persons have been taught to believe that whatever comes out of the computer is objective fact, that this is

the fact the way things are and it is true that in programming these computers to answer questions, some of the personality of the person who prepares the procedure goes in there and gives his own bias as to how the problem is to be handled. All I can say here is one must be extremely cautious to state under what circumstances it is being done and so on, or one could introduce a bias into society.

Well, I wanted to mention a few other points. You could go up to the computer and say, "Look, I don't know much about statistics. Could you teach me a little about statistics?" The computer could come back and say, "Do you know how to find the square root of a certain number?" "Yes, I know that very well". "Do you know how to find the standard deviation?" "No, I don't know that, I didn't get that far". Where-upon the computer, from out of this storehouse of information, could actually say, "Here is the book you should use". Then into the computer you would say, "Here is a little example, suppose you do the arithmetic and see what you come up with". You could work the thing out and say, "I get such and such a number. Is it right?" The computer could say, "No, you must have goofed. It looks as if you are off by a factor of 10. Check your work." So here is a place where you can have conversation back and forth wherein the person at the terminal has the power of a very capable machine in front of him to help him with a piece of information, help him to acquire command of certain pieces of knowledge. This sort of thing is what is referred to as computer assisted instruction. I want to emphasize that this is not a way of supplanting the teacher, but think in terms of what the teacher is best able to do. The best teachers that you can think of are persons who inspired you to get in and dig, not necessarily the ones that gave you the answers or helped you memorize the table of contents or even the multiplication tables. They are the persons who inspired you. We think there is something rather sad about the fact that so much of the teacher's time is taken with routine chores, the balancing of numbers, the grading of papers of factual information which is subject to right and wrong values. A lot of this could be routinized. Furthermore, there is an advantage in giving to a person a prompt response by way of telling him whether his answers were right or wrong. Sometimes our children come home, after having taken a test and we say, "What did you get?" "I don't know, we took it today and we get our grade tomorrow." You ask them tomorrow, "Did you get your paper back?" "The teacher hasn't graded them yet." And sometimes this goes on for a week or two and then when you get the grade you say, "Well, do you know what you missed?" "No, I guess I did something wrong. I didn't pay much attention to it." The prompt attention to an answer can be of tremendous value and computer-assisted instruction projects are designed to help with this teaching of factual information to make the teacher more efficient. Remember our whole purpose is in increasing productivity.

Someone might have suggested to me that one way to try to tell whether there was a man in here or a computer would be giving a very complicated mathematical problem. The man might take several hours to solve and if you wait to get the answer in a couple of hours, well, it is probably a man. Answers to very, very complicated problems come out

in a few seconds, this would be a computer and this would be a good criteria. What could you do in order to make the computer do the processes of man if he is trying to imitate man? He could have a table which had been generated by a psychologist type telling how long man takes to solve various kinds of problems and so after solving this problem he could look up in the handbook, so to speak, and say, "Well, the ordinary man takes about two hours to solve this so I will withhold my answer for two hours". That might not be the way in which you would actually accomplish the result. Somebody might have said, "Let's give the computer the same problem hundreds of times. If it is a man and you give him the same problem hundreds of times, he'll goof and make an error whereas the computer could check his work and get it right." Well, actually there are some mathematical routines in which the computers generate random numbers on purpose to be able to explore the situation so that might not be the answer either.

I did point out that the computers could be used for pattern recognition. I would also like to point out that that room full of gadgetry could be connected by telephone cable to another like room where there is another man so that the one man being expert in one field might communicate with an expert in another field, in case he gets a question too difficult to field. Similarly, computers can be connected, the one with the other so that they may refer work back and forth. As a matter of fact, our company has a tie in so that all of its systems across the country are tied to a common line and when the work load becomes too great at one location it can be shifted to another one. We are going to study the results of this power failure last week very closely to see what implication that might have on our computer network.

Well, let me go on rather quickly to the other three points. I think we have established that a computer can do the routine mental tasks but to instruct this computer it is necessary to actually furnish it with the procedures. These are what programmers do. It takes literally thousands and tens of thousands of them. The number of steps is excessive. I might ask you to put down on a pad of paper the various steps that would be necessary to instruct someone to tie your shoelaces without watching you. Put down point by point each of the things that must be done so that the recipient can take your instructions and not knowing a thing about shoelaces, be able to tie one. I defy you.

To go on to cover the other three points I wanted to make, a computer is an extension of man. Any technological breakthrough in our civilization extends man's powers, the telescope, the microscope, the one letting him see that which is larger and the other that which is smaller. Radio, television, the automobile, the jet aircraft, the computer is an extension of man. If you would think of man being on a typewriter which is a rather primitive sort of instrument compared with what we are talking about here. He has access to all of the information and power of a computer and nowadays through what is called

multi-programming of a computer a number of different person will be at terminals, a little more flexible to their needs than a conventional typewriter, so that each of them at their own terminal may suggest a problem to the computer which it will work out and give back to them where the computer is "sandwiching" or "interleaving" all of these problems at one time. As a matter of fact, I would dare say that we may have something like this in our home where we will be able to transact financial transactions, where we will be able to store information for tax returns, where we will be able to have access to a computer for the solution of mathematical problems, for reference to information type problems and that this is within the realm of feasibility and an economic possibility if we bend our minds to it. The computer then is an extension of man's power. Ministers may use a computer then to get additional information for their sermon materials, access to libraries that they may not have themselves.

The fourth idea that I mentioned is that the computer is a tool permitting cybernation. I am referring to the triple revolution and there are views which oppose some of the ideas there. As a matter of fact, I have some of them myself, but I would like to point out that through cybernetics one makes possible improved, increased productivity where not only the blue collar worker finds himself able to do and produce far more but the white collar worker's productivity is likewise increased permitting a new vista for mankind, greater production. Right now, for the first time in the world's history, man has the facilities that, if we bend all of our efforts, could indeed produce enough food, enough fiber, enough products for everyone in the world. At the present time, since we ate our very pleasant lunch, somewhere between three fourths and four fifths of the world's population do not have a meal such as the one that we had. We have, then, tools for being able to produce so that our economy need no longer be an economy of scarcity. It is not, I repeat, not a free economy by any means. We started with an economy where something like air is free and now there are certain sections of the country, to remain nameless, where free, pure air is utterly impossible. So we have a device that helps us with the physical means of a worldwide attack on poverty, of problems of low income, permitting a new economic outlook and requiring people to give thought to a new economic, a new organization of society and no doubt bringing in a new set of human values, whole new questions in regard to the respect for a new concept of work, leisure, possibilities undreamed of in previous eras. To me these all spell a tremendous challenge.

The fifth point and final one that I want to make is that the computer becomes a focus of ethical concern. A computer makes possible the assembly of factual information so that the decision maker may bring to bear all that he knows in regard to ethical questions. It also poses certain problems that an alert citizenry must certainly be aware of and respond to. How powerful it is when you have all of the factual information about persons in a central bank and how dangerous to the control of a person not fully in accord with democratic methods. We must be sensitive to these new possibilities so that we may guard our own civilization and guide it into a more complete and wonderful era than we have in the present.

P A N E L

WHAT IS A COMPUTER

by

Dr. George W. Petrie

Question: I am curious about pattern recognition. I read something not too long ago in which an expert had said that there isn't a true pattern recognition, as there is in the human. Could you speak further about this?

Dr. Petrie: I think you are quite right. Perhaps we use these words in different senses. One desirable goal is the ability to be able to read information from the printed page and from the written page, so that it can be put directly into a computer without somebody doing the typing. This does not mean, by the way, that we are going to eliminate secretaries entirely. We still have a place for them in our society. To acquire huge amounts of information, some technical problems and pattern recognition have been solved. As a matter of fact, I think it is safe to say that with enough expenditure of effort you could actually make out even poor handwriting, and be able to state letter by letter what is there with a fairly high degree of accuracy. What I was talking about in pattern recognition had to do with more specific applications. Persons now in the drafting world are actually using computers to help them to accelerate new designs, particularly in those products where the minimum time is very important. The draftsman will hand draw a rough line on a special tube. The computer has been programmed to accept the fact that even a rough wavy line is more or less a straight line and be able to use and build with blocks like that.

Question: How do you become objective in matters of personality and dedication and so on, relative to employee selection? Could a computer help?

Dr. Petrie: My own experience seems to indicate that there is no way in which a computer should be given the complete responsibility of saying yes or no to any particular employee in regard to his employment. In our IBM organization we try never to tell a man he is not accepted because he failed the test. We look upon psychological measures as being a very important assist to a manager. After all a person is a very complex assembly of characteristics and capabilities. If one were trying to draw what these are he would have to use a diagram going in many directions, rather than a simple line. You don't just say, well, this man measures 6 ft. 4 in. and this one measures 5 ft. 2 in. and

hence, I'll take the one or the other depending on whether you want the short man or the tall one. Rather you think of his qualifications going in many different directions. I think psychological testing is a wonderful thing in revealing what the possibility problems are so that they may be dealt with directly. It seems to me, that it's the management's responsibility to make the selection.

Question: You made the statement that a computer learns from experience. Whose experience does it learn from? Does it learn from its own experience or does it learn from the experience of others who program its procedures? Then secondly, Dr. Moore earlier suggested that a computer could be educated in areas of medicine and law. He seemed to indicate that not only would there be quantitative decisions but in some respects qualitative decisions could be made by a computer. If this is true, and if there is qualitative decisions what about reliability?

Dr. Petrie: The learning through experience perhaps needs some amplification. If the computer used its own experience, this would not add anything new. In the game of checkers, which I think is possibly the easiest sort of thing to watch, the computer was actually able to say, "Look I lost the game. Where I had the opportunity to make my last selection obviously was not a good move." Or perhaps to go even further back than that, and down grade the method of selection made in the last game, allowing other types of selections to have a higher probability. It is a little bit more complicated than that, but that's the general idea of what the learning experience would be for that particular game. Now, in regard to a computer adding to its memory additional factual information, this is a different sort of a thing. A computer can learn more law, or more medicine, or more economics, or what not, by simply incorporating into its memory the additional statutes. Some of the information retrieval that is being performed on computers today, in terms of law, is actually an assessment of the text of the law. I believe all the Pennsylvania statutes in regard to health are on a reel of magnetic tape. So if you ask, "Where do we have anything with regard to small pox?" You can run right through the tape and find every law that has the word small pox in it.

When it comes to medical diagnosis, again I did not not ask for any value judgments to be given. I understand that there is an encyclopedia of diseases and the characteristics that they have. This information can be put on a reel of magnetic tape, then for any particular symptom one can search this entire file to see what diseases there are in which this symptom arises. It sounds fairly simple. It gets very complicated when you think in terms of the possibility of the complication of two or more diseases.

Question: IBM has assigned you part time to the National Council of Churches, and is paying your salary and expenses. What else is IBM doing by way of interdisciplinary conversation with other agencies, forces, disciplines which will be dealing with the derivatives of this cybernetic age? What is IBM itself doing in research and discussion, again dealing with the derivatives of the age that they are helping to produce?

Dr. Petrie: I will answer the last one first. I'm not sure that it will accomplish anything, particularly, for IBM.

There are quite a number of things that IBM is doing. We want to try to get at the bottom of what is going on. I think probably one of the most noteworthy projects that attracted publicity is our grant to Harvard University of Five Million Dollars over a ten year period. It was given with the understanding that they would set up a project to look into this entire question of what is really going on. What does cybernation really bring? What are the facts behind the pictures there? How does it all balance out and what sort of educational processes can be developed. The grant is to cover the educational aspects as well as the fact-finding, information-gathering aspects. There are a number of other smaller projects of a similar nature. We help the Center for Continuing Adult Education of the Pennsylvania State University. We actually prepare a course for discussion leaders. It is an adult educational course to try to have people better informed of what some of the leading writers are thinking in this field of automation and cybernation. As a little by-product of that, the New York public library is conducting a discussion course on Monday nights for a period of twelve weeks. They get leaders from the community to come together, furnish books for them and try to help people improve their knowledge of what goes on at another level. There are a number of projects of that type. There are a lot of opinions, but no real answers to the question 'does automation increase or decrease the number of jobs'? A simple question like that is subject to tremendous debate. Certainly people who are doing routine tasks are replaced and there is a necessary job training element to retrain them for other useful work. There are several projects that we have in the particular area of re-training which we feel are very important.

Question: What ways, specifically, can blue collar unemployment possibly be improved by cybernetics? What can we do about the blue collar worker?

Dr. Petrie: This opens up a real broad area and different social philosophers have different ideas. I suppose most everyone in this room is aware that a man like Theobald, a well known writer, points with a very dismal outlook to the ability to furnish blue collar workers with work in the future. Hence he feels that there should be a guaranteed annual wage to all individuals whether they work or not. I am not sure that I can go along quite that far. In the first place, I find it hard to envision a society in which we accomplish all of our objectives where there isn't enough work to go around. I think we need some human invention, social invention, to give a little bit more attention to the ability to attack some of the problems that are around us. I don't know how it is in Southern California, but I do know that in the environs of New York there are some places of hideously ugly landscape that need to be cleaned out. There are no machines that

take bad landscape and change it into good landscape!

We know that in New York there are many places where there are working mothers who need attention for their children during the daytime. We also know that there are many women who could perform a nursemaid function, yet they are not doing it. So I say we need some social invention to put these needs and these potential workers together. I think that in our future we are going to recognize that many of the things that we lack are things in which a person works with, or for, a person. If I can give you my own personal experience. I have a 19-year-old boy and we're living together, alone. I would love to be able to get a housekeeper to come in and keep my house for me, but I have no idea how to get an efficient one. This is a problem. It is not as simple to solve as you would think. There are these types of needs. I think we must give more attention to them. When we do, we won't be talking about all these blue collar workers being obsolete.

Now I think we must recognize trends. At one time 80 to 90% of our manpower was necessary to raise enough food just to properly feed us, and we weren't all properly fed then. Now we can raise the food that we need with about 7% of our manpower. It used to take a huge number of persons in our factories and our manufacturing organizations to turn out the goods that we needed, and now we find that we don't need them. As a matter of fact in today's world, we need fewer blue collar workers than we need white collar workers. We are able to make these workers more and more efficient thus bringing down manufacturing costs. We must foresee the time when we will need but a small segment of our population in our manufacturing organizations. Some of us look with disfavor at the government functions absorbing great numbers of persons. Yet this is really what we want. Education, you know, is considered a government function, and in the state of California it is a great and necessary one. None of us have the educational facilities that we want our children to have. We want better ones and we have to expend money in order to get them. We want other things. We want good roads, etc. We want the good things, but we don't want to pay for them. I think in the future we will want to pay for them.

Question: Can you think of any organization or agency that would have less use for a computer than a local church? Could you make some specific suggestions as to what a computer might do for a local congregation as an extension of its ministry?

Dr. Petrie: I will say that an alert church, in trying to perfect its organization, ought to consider the possibility of this type of service, the same as it considers the telephone, electric power, fuel and other essentials. Service bureaus already provide services for very small organizations.

Question: Some young scientists are saying that because cybernation increases productivity there will one day soon have to be

a reversal of values. The highest good will no longer be productivity but consumption. What is your feeling on this?

Dr. Petrie: If we look back a hundred or two hundred years, it was impossible to produce enough things for everyone. If it is a question of this, today we are in a world in which the production of goods can be pointed in any direction that we want. There is very little restriction except as we are restricted in using the earth's resources, and we must be kind of careful with those. Nature is very bountiful but not unlimited. We must, I think, all agree not to be wasteful. I think some of our problems have to do with pollution of the atmosphere, the garbage dumps and that sort of thing, where we seemingly can't use up the things fast enough. We want to discard the old and get on to the new. Whether this is good or not I don't know. If you think of a society in which production facilities can turn out the necessary goods and services, then I think you start thinking about the rules of distribution of these products.

What is it that enables one man to have access to a pile of goods, and restricts another man. Let's take it on more than just the national basis. What is it that permits one nation to be a nation of affluence and plenty and another nation to be a 'have not'? I think there is more of a question of good grace and of well-being and generosity involved here. I personally (and I was asked for a personal judgment) feel there is something which is a matter of judgment about this. A fairness in which we as a society are going to have to learn to act as a result of good fair play. We have to give some of what we have to persons who have not.

At the recent Council of Churches convention in St. Louis, they considered world order problems. One of their resolutions was that the countries who are in a 'have' position, pledge one percent of their gross national product to be distributed to 'have not' nations. I would defy you to argue that that proposal takes too much of what we have, or that it gives to the 'have not' nations too much for their well-being.

Question: Suppose we reach the millennium, hypothetically, when we have an inter-connected computer and we reach the point at which the computer has broken down all the facts and the procedures of human knowledge and so forth. Will the computer then begin to make creative judgments? Can this power be programmed?

Dr. Petrie: It is very hard for me to contemplate a state of society which is status quo. If we try to think in terms of all knowledge having been ascertained, I find it very difficult. I heard an excellent biologist from Indiana University talk about the world of biology, and how meager their information is. How they would like to know the interaction of a number of different things of the animal kingdom. How little work there was on seven of the fundamental animals;

horse, pig, man, dog, cat, etc. I think it is difficult to think in terms of having all knowledge available, but let's skip that one for the moment. To me, society is a dynamic on-going rush sort of thing. Human history is never completely written. Our churches never really think in terms of finishing the task in their community. They think of advancing the Kingdom of God in their own community, but never completely establish it, so that one can sit down and rest. It seems to me if we could methodize everything we know how to do now, so that a computer could take over all of the chores, that our human spirits (our creative brains) would go out and really forge ahead trying to remake a new society. I have no doubt that computers could contribute and help evaluate alternatives of moving ahead. My own personal conviction is that it would be the imaginative people who would be forging ahead, and not batteries of computers.

Question: Can a computer be used to teach the humanities? I also wonder if computers could be used to answer the question "why"?

Dr. Petrie: I may be a little conservative on this one, but I will give you my conviction. I feel that good teachers are an essential part of our civilization. I'm not going to minimize that. The contact with teachers is most helpful and necessary for our children to advance. You can watch in your own homes the reaction of your children towards the indifferent teacher as against the good one and you simply pray that the child's experience will include a few good teachers in his educational life. You're going to be satisfied with some that are just ordinary, but a few good ones are the ones that can inspire. I will come back however, and say that these teachers can be aided tremendously by computers helping with routine tasks.

I really feel that the leadership of good teachers in trying to teach value judgments will go beyond what I can contemplate the contribution of computers making in that field. Computers can help. They can help the teacher and they can help the scholar. I heard recently of the scholar who tried to find out what the influence of Milton may have been on Shelley. He ran through a computer the complete text of their respective works and programmed a diligent search to be able to find what sentence in the one had the most words in common with one sentence in the other. Sentences in their epic poems are tremendously long. The answer is, in case you are interested, that there is one sentence that has seventeen words of Paradise Lost where the same seventeen significant words (ruling out the definite articles and that sort of thing) occurred in the other. The computer, however, did not make a comment as to whether or not Shelley copied the style of Milton or influenced him. That is something the scholar could do. The computer assisted him by pointing out to him the one sentence in the one text that corresponded (by having the most words in common) with one sentence in the other. From then on it was the judgment of the scholar.

CULTURE SHOCK AND THE SCIENTIFIC REVOLUTION

for

Dr. Richard Bellman

You are all aware of the theme of this third Symposium, "Learning and Reacting in Today's World". The next speaker is concerned with man's reaction to the scientific revolution.

He has something in common with many of you, having received his Ph.D from Princeton University in 1946. He was Assistant Professor of Mathematics there from 1946 to 1948; later he was Associate Professor of Mathematics at Stanford, then Visiting Professor, Engineering at UCLA.

From 1952 until this fall he was a mathematician with the famous Rand Corporation, Santa Monica. He worked with medical doctors on the one hand and computer specialists on the other, relating the two disciplines via mathematics.

His wartime and defense activities involve sonar, the atomic bomb (Los Alamos) and thermonuclear weapons. He has published four hundred research papers, authored twenty books and is currently writing a book on Cybernetics for the "Time-Life" series with Dr. Benglesdorf, Science Editor of the Los Angeles Times, who is attending this symposium.

His prolific writings in the field of mathematics are probably unmatched anywhere. He has been editor of three separate math journals.

In September of this year he left Rand to accept a Professorship at USC in Medicine, Mathematics and Engineering, a real sign of the times in inter-disciplinary activity.

He will speak to us on the subject, "Culture Shock and the Scientific Revolution".....Dr. Richard Bellman.....

CULTURE SHOCK AND THE SCIENTIFIC REVOLUTION

by

Dr. Richard Bellman

I would like to begin with one of my pet stories which I think is quite appropriate to this symposium. It is about Gertrude Stein. You remember her, she was the one that was renowned for her perspicacity and intelligence. She made such statements as "a rose is a rose is a rose", among other things, and so naturally acquired quite a school of disciples. As she was dying one of these disciples thought she could get one last word of wisdom from Gertrude Stein's lips, as she was crossing over to the great beyond. Maybe she would have some vision which would even transcend "a rose is a rose is a rose". She leaned over and she said, "Gertrude, Gertrude, what is the answer?" Gertrude Stein summoned up all of her remaining energies, opened her eyes for the last time, and looked up and said, "What is the question?" I think this is so appropriate to so much of the discussion that goes on these days. You see all kinds of people getting up and saying, "We should do this, and we should do that; this is the solution, and that is a solution". There isn't enough discussion of what the problems really are. What are the questions?

What I would like to talk about today is some analyses of the basic problems facing our society. At first I used to feel very awkward about that. (As a matter of fact how I feel is probably described by that famous question, "What is a nice fellow like you doing in a place like this?" The answer is 'just lucky'.)*

Three or four years ago when I first started talking about sociological, anthropological, and moral questions I used to preface all my discussions by "You know I am a mathematician, I am not an anthropologist, I am not a sociologist, I am not even an economist or an engineer. I am a mathematician." After a while I began to realize one might as well leave out the apologies because we're talking about questions that cut across all intellectual boundaries. They not only cross the boundaries of science, but cross the boundaries between science and the humanities. It is necessary then, for the scientist, the mathematician, to be a little bit braver than the non-scientist because at least the mathematician understands a little about what is going on in technology, what is going on in the computer, what the power of the computer is at present, what it's going to be in five years and ten years and so on. He has to initiate the discussion. Essentially, my attitude is that mathematicians rush in where anthropologists fear to tread.

*This is the punchline of a classic American joke not suitable for inclusion here.

I want, then to discuss this question of a society under stress. Where does the stress come from? The title I picked "Culture Shock and the Scientific Revolution" indicates that certainly the scientific revolution has a great deal to do with the stress, but I wanted to use the term "culture shock" first of all to emphasize the fact that we are in a shock situation. I'll explain what I mean by that and also point out that this is not an unfamiliar situation, that we have seen it in many other cultures at many other times. I think there is a famous statement about history that those who do not know history are condemned to repeat it. What we would like to do is to use a little bit of our understanding of what has gone on in other cultures, in other times, perhaps to look ahead, and do a little sensible planning.

What do we mean by "shock"? If we talk about a system, which I understand has been discussed previously, any system whether it be an inanimate or animate system, we observe that any system that you see in the real world is basically stable. This means if you perturb it a little bit, it reverts to its previous state. In a sense it has to be stable otherwise you wouldn't be able to see at all. It would disappear immediately and this holds whether you are talking about physical systems, social systems and so on. All systems have a built-in stability. But stability is not unlimited. This stability is under the assumption that you have a certain type of pressure; a certain outside, external force. If I tap this platform a little bit it vibrates, and then stability asserts itself. If I give it a tremendous push, it falls over; it is now a completely different state and unaided it can never get back to the original state. Now all human societies, as I said before, are basically stable. All those that we observe. They are made to withstand certain pressures. They can stand minor wars, minor economic crises, but when the pressure builds up, then the society begins to show signs of strain. If the pressure builds up too much, then you have a complete breakdown or a disintegration of a society and this is certainly something that has been observed let's say, in the Pacific Islands when the natives have been exposed too abruptly to the white man's society. The previous speaker was talking about the blackout in the east. This is an example of a system which is basically stable under reasonable conditions. When suddenly you get too great an overload, then the whole system goes out. When you have a supersonic liner flying over head, if it were an ordinary plane, you would hear a vibration, you would hear the noise, a mild noise. If the plane is going so fast through the atmosphere that the atmosphere has no chance instantaneously to adjust, you have a basic breakdown in the atmosphere. This is what you call a shock wave. This is a violent catastrophic change in the system. I feel that this is what we are experiencing in our society. It's one of the things we have to worry about.

I would like to discuss some of the things that are contributing to this shock wave, penetrating into every area of our society. These are basically philosophical, moral, and religious questions. One cannot separate these. The most important questions in life, after

all, are those questions that pertain to human beings. The reason why there is so much stress and strain is because human beings are worrying about a number of things.

I think it is important, first of all, to discuss what they worry about, without getting into a discussion of whether the worries are real or not. Essentially if people worry about something, then the fears are real. The reasons for the fear may not be real but this is a different problem and certainly if we are talking about things to do, if we are talking about solutions, it's very important to know our priori whether we are talking about real fears or fictitious fears. Fictitious fears, perhaps to some extent, can be swept under the rug. If the fears are real, there is no way of getting rid of them in that easy way. Now, what in my estimation, are the principal worries? I would like to begin by saying that some of these worries have been with mankind from the beginning of time. Some of them are unique in our society. They are all unique to our society as far as the rapidity of transition is concerned. We have had equally bad times in human culture, let's say back in the Industrial Revolution, as far as loss of jobs and dislocation of society. As far as the magnitude of the problem, the rapidity, this is a fairly new situation.

Let me discuss the five areas in which I think there is severe difficulties. First of all, there is the questions of survival. One of the reasons why a person is willing to be a citizen of a society, to pay taxes, to conform to laws and conventions, to serve in the military, is because the society gives the individual many things. One of the things that a society used to be able to provide an individual is safety. Society would essentially guarantee for the great majority, at the expense of a certain minority in the Army, in the Navy, in the Air Force, safety against attack. Now one of the fears we have today, is the fact that no nation can guarantee survival to a great majority of its citizens. Is this a real fear? It is a very real fear. I don't think there is any question of it. If you think of an ICBM intercontinental ballistic missile with a hydrogen bomb warhead megaton bomb capable of destroying several million people in a city in a matter of a few minutes; if you think of hundreds of such missiles sent off in a matter of minutes or hours, this is a very real fear. What is the protection against that? Practically nil. I think at the present time with good luck and complete efficiency, interceptors might get rid of one missile in ten. Let's say that they improve efficiency, we get bigger and faster computers and better mathematicians. Let's say that we get it up to 9 missiles out of 10. It doesn't make any difference. The one out of ten is still sufficient. We face therefore, a new situation in the history of the world in which a whole nation has to worry about destruction in a matter of a half hour or an hour. This is a real fear. It is a legitimate fear.

To pretend that it doesn't exist is very dangerous. Subsequently, I

want to say a few words about what can be done as far as some of these fears are concerned. But I think the first basic problem, as I mentioned before, before talking about solutions is to talk about what some of the realities are.

Granted survival, the next problem is that of gainful employment, a job. Dr. Petrie mentioned some of the facts concerning automation. I'm sure you have read a great deal about it and some of the other speakers have spoken about this. A number of fortunate people, in person-to-person professions, are immune from the dangers of automation. This is one of the advantages of being a minister. We could probably get a computer to deliver sermons but that is probably the least, one might say, of the difficult duties of a minister. One doesn't have to worry about a doctor or a lawyer or a teacher being automated. But if one is a blue collar worker, if one is a paper shuffler, if you analyze what the great majority of people do, you find that these duties, that these services, can be quickly, easily and efficiently replaced by computers. This is a real fear. There is no question about that.

Third, granted survival, granted a job, there is the problem of individuality. What kind of job is one going to have? Are you going to have a very boring job just twiddling knobs? One of the difficulties about automation is not only does it diminish the number of jobs, but it downgrades seriously the number of remaining jobs. Consequently you have a double threat. You all probably remember the picture with Charlie Chaplin in "Modern Times", in which the man just twiddles a knob all day long. Well, of course, we have had situations like that for a long time but at least it was a knob he was twiddling. He was doing something on a production line. It's going to be very much worse when people have to sit and baby-sit computers. This is a much worse situation. Then you have to worry about the destruction to human psychology, the alienation, the feeling of a man not being a man. All through recorded history man has been accustomed to being a bread winner, a hunter of animals, a person who really goes out and uses his muscles. He has had a certain role. What happens when you get rid of that role? What happens when you take women out of the home and they are no longer raising children? When they are just doing very routine and menial jobs? These are very, very serious and real problems.

Fourthly, there is the question of beauty or aesthetics. If you look at one of the results of scientific revolution, you find it sort of strange that a lot of things are done more efficiently but they are done in a very inconvenient and very ugly fashion. There have been many talks and papers delivered recently on the fact the city as a machine serving mankind has outlived its usefulness. We have now let it go to an extreme. The city is now a very ugly, dangerous place, dangerous as far as crime, dangerous as far as health, dangerous in many different ways. Certainly people who grew up outside the cities and who are now forced to live in the cities, people who grew up in a rather leisurely pace who were accustomed

to taking a three day ride across country and now take a jet plane, are very, very uncomfortable. It's quite interesting to sometimes fancy yourself an anthropologist visiting a strange land. We look at people who are quite well-to-do, well-to-do enough so that they can take a trip across the waters, across the country when they have to conduct business, and you look at how they live. You think of the kind of life that they subject themselves to. They have to get up at, let's say, 6:00 in the morning because they live two hours from their office. They have to travel on crowded freeways. It's the only way to get there. Then they take a jet plane, three on a seat let's say. The trip is just long enough so that it is uncomfortable and just short enough so that you can't sleep. You can go on and on about the inconveniences and the ugliness of daily life and I think you agree that this wears on people. It becomes an irritant, a subconscious irritant without their knowing it.

Finally the question of the spirit. I think that one of the aspects of the stress of modern life is that more people are forced to think about basic questions than ever before. I want to return to this because I think it's one of the good aspects, it's one of the bonuses. Even a businessman, somebody who makes his living dealing with doers all day long is still a human being. He still worries about his society. The man who has to bribe a government contract man with \$10,000 or \$20,000 to get a million dollar account, does it to survive but it doesn't make him happy. I think that all through our life we see that, we see people forced by the exigencies of our society to commit all kinds of actions that they know are immoral, illegal, wrong according to all their standards, certainly wrong by their Sunday standards. Yet they are caught in this, there is no way out; they have a tiger by the tail; you can't step down; you can't let go. They are worried about the fact that we may be in a society in which the computer does the value judgment. This was one of the points that was raised in the previous panel discussion and a more sophisticated point is how do you prevent the computer from doing this. Your first question is do you want the computer to do it? The second question is how do you prevent the computer from doing it automatically in the following way; again a point that was raised previously.

You take this perversion of psychology known as intelligence tests and personality tests and self-adjustment tests and so forth. This is a way of passing the buck on the part of the manager. Obviously it is quite difficult to appraise a candidate. One of the most difficult things that any teacher has to do is to examine candidates for a graduate school. Let's say you are at a fairly good school in mathematics like Princeton where there may be room for maybe ten or twenty new graduate students in mathematics per year and you have 300 or 400 applying. How do you make a judgment when you know that this judgment is going to affect the whole future of the person? Obviously it is very much easier when you are running a big corporation to make the candidate take a battery of tests. Then if one person

scores 73 on one test and 50 on another and the other candidate scores 71 and 48, well, you say obviously we take the first candidate. This is what I mean when I say it is very difficult to avoid having the computer do value judgment. When you are talking about the design of a huge system, let's say it's a question of giving a hundred million dollar contract to Texas. I guess there isn't any question there, let's go on. It's pretty hard, as a matter of fact to find any state; let's take Arizona, that's a nice neutral state. Let's say we're talking about one state that doesn't want federal assistance and is having money forced on it reluctantly. Obviously when you are talking about a big water resources project, let's say we're talking about a project that is going to make the deserts of California, Arizona, and New Mexico habitable and you have different ways of getting water into these areas. You can get water from up north. You can think of a desalination plan and you can think of other techniques as well. Now the engineers come up with various cost figures but we know there is much more to it than that. When we are talking about cost and efficiency, the question is how much is it worth to the country to open up a wilderness to 10, 20, or 30 million people over the next 10 or 20 years? The natural human way to answer these questions is to avoid them. You leave them out of your formulas and you do the whole systems analysis in terms of quantities that you can compute, quantities you can get numerical value for.

Consider the situation of a higher echelon decision maker with two plans. One plan costs 50 million dollars, one plan costs 100 million dollars. If he is doing his job, he calls in the people who are responsible for these plans and he says, "Please tell me what assumptions you have made? What factors have you taken into consideration? How have you counted the return on a dollar spent here versus a dollar spent there?" But upper echelon decision makers have their responsibilities and difficulties too. The easiest thing to do is to say, "Here is plan A, Plan B and Plan X. Plan A is recommended by six California engineers, cost 50 million dollars, therefore, obviously superior to something which costs 100 million dollars. This is what I mean when I say you have to be very careful about the computer performing your value judgments without your even knowing it. This has been one of the objections that the generals and admirals have against McNamara. How do you take in intangibles such as morale? How do you know that you have taken care of all possibilities in the future? How do you know you have taken care of this and you have taken care that when you come up with a nice slick, streamlined computer estimation of a situation. (Incidentally I think the generals and admirals are wrong. Let me just say that parenthetically. But they could be right. You see the questions they are asking are right, it just happens that they are wrong). But I think this is important to what I was saying before. In order to answer questions legitimately, you have to allow them. Often what you find, that people are espousing one position, trying to pretend that there is no valid reason for another position. This is a very dangerous point of view. My feeling is if your position is right, you should welcome discussion and

and criticism and other points of view because it should only emphasize the validity of your own position. Certainly you cannot get rid of sub-conscious fears by pretending that questions don't exist. Let's say we are talking about McNamara answering his critics. It is not a good answer to say, "But I have six computer experts who tell me that this is a more efficient way to do things." It's not a good answer. The correct answer is to point out explicitly what the admirals and generals have in mind, why they are interposing these criticisms and then point out the reasoning that goes into overruling them. This is the correct way to do this.

These then are the five basic areas: The question of survival, the question of job, the question of individuality, the question of aesthetics and the question of spiritual values. The last is probably in many ways one of the most pressing. The fact is that human beings at all levels are all seriously worried about loss of humanity, about being a number, a cog, a punched card that is not supposed to be mutilated, even with a sharp nail. (I want to thank Dr. Petrie for that suggestion because I have been using a pencil.) I understand incidentally that if you know how to do it, you can take these IBM cards that you get from magazines and if you make just the right little mark on them, you can get a lifetime subscription. I think the right penalty for that is to have your subscription to Playboy magazine changed to Field and Stream.

Now I really wanted to discuss what I considered some of the basic problems, the basic fears. I would like to discuss the more favorable aspects. Actually I might say parenthetically again that I am basically an optimist. I think that we have the great society which is getting greater in every possible way, that so many of these problems are just birth pains. These are just the labor pains of an even greater society. I feel that there are no problems we face that can't be solved. I feel that the fact that there is stress doesn't mean that we are a sick society. We see all kinds of articles on this. Certainly if you look at the playwrights and the novelists and the artists you get the feeling that we are very sick and decadent and a degenerate society. I think there is a reason for this. I think that these people feel that they are not where the action is, to use a Broadway phrase. They feel that to an enormous extent our society has become a scientific, technological society and they are very bitter about it. Certainly if you talked with the scientists, you find that they are extremely optimistic, because for the first time they see a chance of obtaining solutions to the problems that have intrigued them for many years. You have under development microscopes that are going to be able to look into the cell. We have all types of hopes and ambitions, particularly in the bio-medical field, This is the most vital and exciting field.

Consequently we have a very peculiar dichotomy in our society. If you talk to the humanists you find them very discouraged. If you talk to the scientists you find them very, very hopeful and I think

that our society is going to be saved by a combination of science and humanity, but it is going to be a new type of humanist. It's going to be a humanist who accepts science as a natural part of every education just like a well-educated person in the humanities accepts Latin as an essential part of every education in the humanities. I am basically then very optimistic. All of the people that I work with in the bio-medical, engineering, mathematical, physical field, even in the economic field, are optimistic, but when I go to parties and I meet writers and artists and musicians and playwrights then it is very hard to believe that they are talking about the same society. It is very, very surprising. You have the feeling that this is a very different world.

But what about these fears. What can be done about them and what are the favorable aspects. In the first place, I am sure we agree fear by itself is not a bad word. Fear is a very natural protection device put in to alert us to dangers. Thus it isn't the question as to whether we have fears or not, it is a question of what do we do about these fears. Do we operate successfully despite having these fears? This of course is where the moral and spiritual values become extremely important. There is nothing more important than philosophy and the basic philosophy of our time should be 'there is nothing more important than man'.

As Dr. Petrie mentioned, taking the area of automation, all we have to do is look at the requirements of man, starting from the cradle and going all the way up through old age and it is clear, not only won't there be a shortage of jobs, but we don't have enough people to do the type of thing that we want in any kind of effective way. It's just a question of what people are willing to pay for. Certainly several hundred years from now people will look back at space travel, at the fact that in 1965 we were spending a billion dollars a year to get to the moon, the fact that we contemplate going to Mars they will say obviously there was a great need for more psychiatry at that time. I think that it is very important that citizens begin a counter attack. We have been sold the space program in the name of science with a capital "S". It's about time we looked into this and asked ourselves, "Is this really what we want to spend our time and energies and resources on?" At the present time for the next couple of years there seems to be no way out incidentally. We're in a transition period and we have to provide jobs in some way. The space race is a fine way of providing jobs. I don't think we ought to laugh at it, but I think we ought to start forming underground cells for other activities; the questions of water pollution, smog, traffic control, education, all the things that really count as far as the human society are concerned. If we look at those problems, my feeling is there is no danger as far as automation is concerned. As far as the H-bomb and as far as automation are concerned I think that the most important aspect has been that it took something of this magnitude to force people to re-evaluate their philosophy. As long as we can have a small war that was good for business, then

people weren't going to make a big fuss. As soon as you have the possibility of a war that can destroy all of civilization then obviously you have to spend a great deal of time and effort thinking about it. As long as we can have a small amount of obsolescence of human beings, as long as there was just a few thousand people who we put out of jobs, we didn't have to worry about automation. After all we live in a society in which 40,000 people a year are killed by automobiles and we don't think of declaring the automobile illegal. We are a society that stands a great deal of stress that way, but when it comes to a question of hundreds of thousands and millions of people being put out of jobs and the whole structure of society threatened then we have to start asking ourselves the basic question of what do we really want.

I think this has been the most beneficial aspect of what has been going on over the last fifteen years. No longer can we sweep these questions under the rug. This is now every citizen's question, basic question; his survival, his whole society depends upon this. For many years, five years or so, I was talking about the dangers of automation. I was talking about the dangers of having hundreds of thousands and millions of men who were uncommitted to our society; men who had no jobs, had no responsibility, who really didn't even care what kind of society existed. I think that the riots in Watts indicate very clearly what the middle class citizen has to worry about, if he doesn't worry about automation. Too many people who are not white collar people in the clerical sense, too many people say, "Well, this isn't my problem". The answer is "It's everybody's problem". There is no way of escaping these problems anymore and I think this is very much for the best.

Now, as far as the other questions are concerned, individuality, aesthetics, spiritual values, I think that the first two act as the catalyst. They force people to think about these problems that they should be thinking about. There again, I feel that it is very much for the best. I feel that we have within our philosophies, within our system of government, every possible chance of going in the right direction. We are very, very fortunate that transitions are quite easy. Through remarkable luck all these transitions were made possible in our constitution. There is nothing that can't be done by simple democratic vote. It's as easy as that.

I feel, particularly at this time, that people like yourselves play an absolutely essential role. After all, what other segment of society is essentially paid to be philosophic, paid to be a spiritual leader. No other people have the time. This is essential and I think what you can do when you go back to your own churches, to your own communities, is to start these discussion groups. (I have my own ideas of what should be done but that is not very important). What is very important is that all the citizens discuss these questions; that people look at the various problems, at the various possible

solutions and then come to a consensus through a perfectly simple democratic process, through a popular vote. This is the most important thing that can be done at the present time.

I usually wind up one of these inspirational speeches with the following story. It's the story about the football coach who comes out for the first day of spring practice and looks over last year's squad with a certain amount of distaste, wondering why he didn't become a minister like his mother wanted him to become. (But then maybe some of you wonder why you didn't become a football coach.) And then his eyes light up; he sees a fellow who is about six feet four, about 250 pounds. He hasn't seen this big husky kid and he looks at him and he says, "Ever play football before?" "Yes," says the kid. "I've played some in high school. I was All-State." The coach gets a little interested and he says, "Can you run?" "Yes", says the kid, "I can do a hundred yards in ten seconds with my football gear on." (Well, it's a question of which direction, of course.) He says, "Can you kick?" The kid says, "Well, 60 or 70 yards at a try." This is too much for the coach and tears begin to course down his cheeks and he looks up to heaven and says, "I don't deserve it, but I'll accept it". He says, "Can you pass?" "Yup", he says, "Standing still or running through the center of a tire 40 or 50 yards away every time." This, of course, is completely too much. The coach just gets down on his knees and he clasps the kid around the knees and he says, "Son, I'm an old man", he says, "Now don't torment me, there must be something. You failed mathematics?" "Nope" the kid says, "Straight A student in high school, straight A in my freshmen year." The coach still can't believe it, so one last time he says, "Now, I don't care what it is, there must be one little flaw, anything, I don't care, just tell me that one little flaw". The kid shuffles a little shyly and says, "Well", he says, "I do lie a little".

P A N E L

CULTURE SHOCK AND THE SCIENTIFIC REVOLUTION

by

Dr. Richard Bellman

Question: Professor of mathematics, engineering and medicine.
How do those three come together in one person? What does your professorship mean in terms of those three disciplines?

Dr. Bellman: I think one of the famous biblical quotations is the most difficult for man. How does he justify himself? But to explain the professorship in mathematics, engineering and medicine is not as strange as it seems. As it has been discussed in previous sections of this symposium, people are now very much interested in the study of large systems, large complicated systems. Whether it is an economic system or a biological system, there are certain structural properties in common. There are certain mathematical tricks in common, and what is certainly common to all of them is that you have to use big, fast computers if you expect to make any progress. One of the fields that is opening up is the biomedical field and people realize that they have to introduce modern sophisticated mathematical techniques with computers. There aren't many respectable physiologists around, or M.D.'s who know that much about computers! There will be in ten years or so, but right now they have to use "refugee mathematicians".

Of course, there is an additional point. It's really quite a selfish point. It's a point I make when I talk to graduate students. You see young kids of 20 or 25 who are Ph.D's and I ask them what they are working on. Well, they are working on space problems. How do you get to the moon? How do you get to Mars? Or they're working on what goes on inside the nucleus of the atom. Then I say: "This is very interesting. They say you're very intelligent people. You know what the statistics are. You know, let's say, that 55 or 60 per cent of all adults are going to die of heart trouble, the remaining are going to die of cancer. If you don't die this way, you're going to have a stroke or some other unpleasant ailment. Now, why is it that you people who represent, let's say the upper 1% of the population, as far as abilities and mathematics and physics and engineering are concerned, don't you spend your time on something that is of direct personal value?" I say, "When you are in that hospital bed thirty or forty years from now, you remember that you had a chance and you spent your time on going to the moon." This shakes them up. I don't think that they have any good answers. Nobody has

ever asked them that question. Thus one of my feelings is that this work in the biomedical area is a very selfish thing to do. There is a high probability that some of the techniques that may be developed, let's say in the diagnosis of heart disease and treatment of cancer by means of radiation, can actually be used. Thus there is a personal motive.

Question: You're an enigma. You are bringing together disciplines. Is this a new trend in university life today? Is this the trend?

Dr. Bellman: It's been the trend in intellectual life since the war. During the war it was done in classified military projects. After the war, people began to realize that all the major problems of our society fell outside any of the administrative units in the university. There is no reason for a separate department of engineering, mathematics, physics, chemistry, biology and so on. If you take a problem like cancer, this is not solely a medical problem. You know the famous quotation, "War is too important to be left to the generals." It's the same way with medicine. Medicine is too important to be left to doctors.

Question: As some of us have been doing our homework for today's session, reading some of the material that was provided for us, we find over and over again the thought that one of the dilemmas we face is that we are less and less qualified to evaluate the decisions reached by the computers, or to even evaluate the procedures which they are recommending. We might not even be qualified to pull the plug of the computer. I wonder if you could speak of this dilemma and the way out of it as you see.

Dr. Bellman: I think it is a very real problem. As a matter of fact, just exactly for this reason, I was so enthusiastic about this symposium. I think that it is tremendously dangerous to a democracy when you have a new type of priesthood. If you think about, let's say, the medieval ages, you had a few people who were qualified to read scriptures and everybody else had to take their interpretation of what the truth was. We have a very comparable situation today. The new sacred language is mathematics. This is amplified by computers. We only have a few people who really understand that language and the average person has to accept this as gospel. This is an extremely dangerous situation I think. The only way out of it, as usual, is education. There is absolutely no reason why every person in public school should not be taught how a computer works and be completely familiar with its workings and understand its very natural limitations, what it can do and what is absolutely impossible for it to do. I remember I received a letter from a lawyer in Toronto. He was very grieved about Eichmann and he asked me whether I could use a computer to determine what the proper punishment for Eichmann should be. This was a man, you see, who was presumably an educated man, yet he understood so little about what a computer could do that he actually thought of it as some vast oracle. You just write the problem legibly on a piece of paper and slip it in and the answer comes out. I think that this was pretty much the

the opinion up to a few years ago of most people. I think as a result of tremendous educational programs fewer and fewer people believe that, but the situation is still very dangerous.

Let's say when you get up to the Pentagon level, when you are to the presidential level, how does a man on that level really make a decision as to the competence of his experts? How does a congressman, for example, know what questions to ask? Let's say that somebody from Minnesota won some Nobel prize. He wants a new element named Minnesotium and North Dakotium, and so on, and he wants \$500,000,000 for the accelerator. It is just coincidental. Incidentally they do actually want the \$500,000,000 for an accelerator. Now the congressman who is not trained in physics or engineering or technology doesn't even know how to interview these people. He doesn't, for example, know how to ask basic questions such as, "What are you going to do with the money?" "What advances are you really going to get?" "Don't tell me it's reasearch. I accept the fact that it is reasearch, but tell me specifically in dollars and cents why you would rather spend \$500,000,000 on that than let's say some other project." Now, you see this is the kind of question that a person who has had a rudimentary training in engineering and technology can ask. But a person who has not been exposed to this at all, a person, let's say, who has gone to law school, doesn't know how to do this. The first way around it I think, is in education. We must (in high schools and in the colleges) force everybody (whether they are going to be a doctor, a lawyer or a minister, or a butcher or a plumber) to understand these basic aspects of our civilization. This is going to be our civilization from here on in.

Then simultaneously, for the next couple of years, we need what I call retread programs. We have to take the people who graduated from school ten and twenty years ago and give them refresher courses, short symposiums like this, and get them to understand. We are concerned, not with the details of a computer, but with the kinds of questions you can profitably answer with a computer. What kind of questions you can profitably answer with a \$500,000,000 accelerator? What kinds of benefits are you going to get from a man on the moon or a man on Mars? If the government wants to say this is the only way we can provide full employment at this time, this is a perfectly reasonable answer, but we should get an honest answer, not that we're going to the moon because it is there. Or another one, that is one of my pets in the editorial columns, that Columbus set out for American in 1492 and he didn't know what he was going to find. This is, of course, complete nonsense as far as history is concerned. The only possible cure for this very dangerous condition is education, panels of this type, symposiums, discussions, courses and so on.

Question: Having heard recently a great deal of anti-technological literature and comments from great philosophers from the arts and from the entertainment world, do you feel this is reaching a danger point in our society? That is, the involvement of "artistic"

people in the decision making process?

Dr. Bellman: I think it has already reached a danger point. I think a danger point was reached ten years ago. I think that the middle class, in which I include all of us, the middle class has bent over backwards in a perversion of democracy, freedom, liberty, tolerance and so on. We tolerate people like Genet, let's say with his play; we tolerate Leroy Jones; (he's the one who wrote the play called "The Toilet" that caused a certain amount of trouble in the Los Angeles area about a month ago) we pay too much attention to people like Tennessee Williams and so on; one can just go across the board. Here is a group of sick people. The fact that they happen to be artistic geniuses doesn't have anything to do with the fact that they are sick. Instead of the middle class looking at these people and saying you're sick, they take the attacks very, very seriously. They don't know how to answer them except by a rather foolish censorship, which I think is the worst way to answer. They are trying again to pretend that certain questions and difficulties don't exist, but because of this alienation, because the middle class has been so tolerant I think that certainly many of the younger people, many of the students get tremendously confused as to what everything is all about. There have not been enough effective voices raised in the other direction. There hasn't been enough people coming out and saying, Genet is sick, Jones is sick, Tennessee Williams is sick.

Let's take the problems they're raising and discuss them in a different atmosphere, but let's view these people in perspective. You have the same difficulty of course in the arts. You have the difficulty in the novel and so forth. Yes, I think we have paid an extremely heavy price for the alienation of these people and I certainly don't have any easy way of answering it. I don't think there is any easy way except that the questions have to be brought up instead of people going to see Tennessee Williams on a Saturday night and sort of shaking their head, or getting a certain amount of amusement out of it and saying, "well, this is just a passing fad." It doesn't affect my stock brokerage business, or my being a minister, or a mathematician. This should be viewed as a systematic attack on middle class mores and middle class society which is extremely dangerous.

Question: I have read estimates by the Rand Corporation that by the mid 1970's two percent of the labor force can produce all needed goods. Would you give me your opinion as to how our society could survive this state of affairs? Would the other 98% all be poets or preachers?

Dr. Bellman: Equally divided, it might not be a bad idea! As far as the quotation is concerned it is a statement which I made several years ago, and it is a very conservative statement. The trouble with most people is that they can't do arithmetic.

Consider what the population is going to be in ten years. Let's say it's 200,000,000. 2% of 200,000,000 is 4,000,000 people and what I was talking about is that if you take the number of people employed by manufacturing and the number of people employed in agriculture, which I think now is about 14,000,000 and if you then say with the tremendous changes that have taken place in technology and in the use of computers and in automation, if you say that this 14,000,000 goes down to 4,000,000 you're not being terrible radical or terribly bold. As a matter of fact I deliberately used 2% because I thought in my own mind that the two tenths of one per cent was a much better estimate! In other words, the 14,000,000 goes down to 400,000. But two tenths of a percent, this is an impossible figure. It isn't a very bold estimate at all if you look at any of the current magazines. Pick up Fortune Magazine, for example, and just notice in practically every issue what is reported about automation of this industry and that industry and cutting that labor force. As far as how a society can exist? The answer is there is no reason why our society has to be largely devoted to manufacturing and agriculture, when this work can be done by a very small part of society. As Dr. Petrie mentioned, and as I mentioned before, if we think of the human needs, if we think of the problems of childcare, of teaching, of the aged, etc., etc., if we think of just making life pleasant for people, then the remaining 98% of the population need not be condemned to be either poets or preachers.

Question: Do we have the time to build the machines to allow the rest of us to get out of manufacturing?

Dr. Bellman: Well, you take the medicare program, for example. Now try making some estimates about the number of people that are going to be required to run this program. Just think of the clerical aspect of it. Think of what happened in Britain when they introduced medicare. They made some estimates as to how many people required eye glasses, false teeth, hearing aids and so on. I think they were off by something like a factor of ten. If you think seriously of taking care of people I don't think there are enough people in the population to do it. As far as payment is concerned, my feeling is there is no reason why they shouldn't be paid in the same way that we pay people to work on the problem of going to the moon. We tax ourselves to pay ourselves. It goes in one pocket and out the other. I don't see any difficulty. All of the agitation of five and four and three years ago has already paid off, so I don't think you're going to see any dismal situation in a couple of years as far as automation is concerned. I'm an optimist. My feeling is it is a very sensible philosophy because you don't affect the future to any extent. What's going to happen is essentially going to happen. If you're a pessimist, you just suffer all along.

Question: I seem to hear Dr. Bellman saying two things: One, automation will force an upgrading of requirements in education, two, it will downgrade the quality of jobs such as baby-sitting computers. It seem that a large element of our population is dedicated to ignorance. Educated people are called squares. The

only safe place is a status quo. How do you explain this?

Dr. Bellman: Let me say that I speak with a forked tongue. The statements may appear paradoxical but I think it is easy to explain. There are many clerical jobs, paper shuffling jobs that once required trained people, there are jobs involving running some of these big tools that once required ten, fifteen, twenty years training. I don't know if you saw the big exhibition, in Los Angeles a week or two ago. These big machines are now run by a computer. Now you may not even have to have someone around to pull the plug if by some accident the machine goes haywire. I think all that is required of the human being is that he put the piece of metal in and fasten the devices. You can train somebody, let's say conservatively, in a month to do that. So this is what I meant when I said that the jobs that remain are going to be on a lower level. Now, as far as a higher level of education being required, if a person doesn't want to do this low level baby sitting, if he wants to use the computer on a higher level, then he is going to have to get a much higher degree of education. He is going to have to be a professional man, a professional engineer, mathematician, physiologist, etc. So I think there is no paradox there. Now what was the second question?

Question: The second part was, so many people are seemingly dedicated to the status quo.

Dr. Bellman: I don't believe that. I think you see a certain amount of it. This is a fear reaction. Obviously the simplest thing to do is just run and hide. When we were in Sweden about two years ago we were talking about something going on down South, as usual, and the Swedes were rather indignant about it, and people were sounding off. I said, we're a nation (again elementary arithmetic) of about 200,000,000 and conservatively we have about 4 or 5% nuts. We have more nuts in the United States than the whole population of Sweden. So when you say a lot of people are dedicated to this, or dedicated to that, or to the status quo and so on, I say that just a few hundred thousand people can make a tremendous amount of noise, but they very seldom reflect what the over all feeling is. I would feel that it is the other way around. I think that in almost every segment of our population at the present time the need for education is recognized. Let's say that the lowest level, the low man on the totem pole is in the Negro population. The Negro parents recognize very clearly, if they want their children to have a chance, they had better get an education. So I would say the situation is just the opposite to what you indicated. I would say there is a greater interest and a greater understanding of the need for education in this country than ever before. As far as the egghead is concerned, I'm sure most of you know the famous study that was done by a psychologist at Stanford about thirty years ago. He studied about 5,000 superior children and found that the superior children were better athletes, better adjusted people, make more money and so on and so forth. I think that speaks for itself. I don't really worry about the egghead.

Question: How do you view the changing role of women in the decades which are to come?

Dr. Bellman: That's an interesting question. I would say that one of the favorable aspects of automation is that it is going to force women back into the home. After all this is a guaranteed job that a woman has. She is the only one who can bear children. (Bear them in two ways, bear them first and endure them later). I always look around the audience and keep a safe distance from the women because they start coming out of their chairs after me when I talk like this. Actually we can take it for granted that we're living in a more and more democratic society with more and more equality of opportunity. A woman who happens to be a brilliant mathematician now for the first time in history has a chance to be a professor in a university with a minimal of intolerance and prejudice. So there is certainly that opportunity, but if you think of the job that the average woman has out in the business world, it is hardly a very exciting or challenging or pleasant one. So to say that these women will then be able to return to their home, and be supported by having a salary as a homemaker and as a wife, (which isn't a strange idea because it's done in many, many countries; it is done in Canada where women are paid so much more for every child), is a very natural idea. I think that after this transition time, which has been very, very painful, the relations between the sexes will get better than ever because women will, I think, end up being very grateful that they have this permanent job while men have to worry.

Question: When the children leave the home; then what?

Dr. Bellman: Well, it seems to me that is where these other needs come into play. No sensible, intelligent woman is going to want to sit around the house and play gin rummy with her friends all afternoon. If you look at the situation in hospitals, it is hard, for example, to think any time in the future when hospital aides will not be needed. As a matter of fact the standard comment that most hospital directors make to these volunteer housewives is that we couldn't afford to pay people like you if we had to hire you. So there is certainly going to be need there, a need in community work, a need in teaching and so on. My feeling is that this is the sensible time then for a woman to go out of the house. When she has achieved an age of maturity, she has had experience with her own children and managing her own household, then she can make a real contribution to the community.

Question: Do you think that the use of a scientific process in the area of social science is a good thing? If your answer is yes, how can we accelerate this?

Dr. Bellman: Well, it's hard to see where one wouldn't want to use a scientific process. All there is to the scientific process is the use of intelligence. So the question really reads, "Do you want to use intelligence to solve social problems?" It's hard to be opposed to that. I think what the question means, is there some particular mystique that the scientist possesses to solve social problems which the nonscientist doesn't know about? The answer to that is no. There is no special problem solving technique that the scientist knows that the nonscientist doesn't know. It's just that the scientist has been trained in certain techniques called the scientific method. This is just the method of common sense and intelligence. Hopefully after having done this for a number of year, through undergraduate school and graduate school, and in his own reasearch, he's trained in his own field to use these techniques. Needless to say as soon as he steps out of his own field, he becomes an amateur like everybody else. This, of course, is the danger. The person who is not scientific thinks that the scientist possesses special technique. So if the scientist leaves nuclear physics and becomes an expert on civil defense, the average person is apt to think, 'well this fellow must be speaking with a great deal of authority because he has a Ph.D. in acoustics! Now this just isn't the case. As a matter of fact the situation is very difficult. In the first place, the non-scientist thinks that the scientist possesses special techniques. The scientist also think in many cases that he possesses scientific techniques, and also he has the misconception that the problems in the social sciences are less difficult than the problems in the physical sciences, which is just the reverse. So when you have this double misconception taking place you are in a very dangerous situation.

The point that should be remembered is that people as people essentially tackle the problems that are easiest to solve. If you ask yourself what are the simplest intellectual fields, the answer must be chess, mathematics and certainly, let's say in the artistic field, playing the violin or the piano because you can have prodigies, you see. Any field in which you can have prodigies cannot be a very difficult field. You don't get prodigies in politics or the humanities. You don't have prodigies in philosophy. These are far more difficult areas and so people stay out of them. Now we have no choice. I mean now these problems have impinged themselves upon everybody and if a person like myself wants to preserve the very pleasant society, at least for himself, then he has to leave the armchair and go out and operate to some extent in the political and social and economic world. But one is strongly aware there are no royal roads through social problems.

Question: Another subject. A scientist has said that he expects a cure for cancer to come from the exploration of the moon. Do you see any validity in this?

Dr. Bellman: I think the proper way to describe that is lunacy.

Question: As Mr. Petersen said the other day, is it not conceivable that there will be a great deal of fallout, technological fallout in something like the Apollo program?

Dr. Bellman: It's certainly conceivable. I think this is similar to the situation that we were talking about before about McNamara and the generals. It is certainly a perfectly reasonable statement to make. It just seems to me though that if you look at these programs over the last ten years and ask 'what kind of fallout have you had either scientifically or economically', you find that it just hasn't worked out. I don't think it's worked either scientifically or as an economic boost to the society. Many people have pointed out that the same amount of money used to start other industries and other enterprises would have been very much more fruitful to the economy.

Now I would say that scientifically I don't know what contributions you ascribe to the space program. They have, however, been very useful for consulting purposes. I admit I have taken money from the space agencies and industries from time to time. My excuse is that I donate to various charitable enterprises. They also support graduate students and young instructors. I think that most people agree it is a boon to our economy. If you just had an instrument on the moon or an instrument on Mars program, if you got rid of the man on the moon aspect, a man in Mars aspect, then it would be worth tolerating.

Question: If survival is a real thing, then is it not our number one program? What can we as ministers and churchmen do? Should not our greatest efforts be centered on the elimination of armaments?

Dr. Bellman: This again is a very plausible question and there certainly is no easy way to answer it. I think the only way to answer it in some effective fashion is to say that we live in a complex system. There is no one aspect that we can devote ourselves to exclusively without worrying what else is going on. Now certainly survival is important, it is essential, but survival for what kind of a society and under what conditions? This is also an important point. Why should people care about surviving if they are not living well? Why should the Negroes in the Watts area particularly care, let's say, whether New York, Philadelphia and Washington are destroyed by an atomic blast. These people have no commitment to their society and I think this is part of the problem. It has to be a society that merits survival, a society that people want to work for. It appears to me that one of the best ways to guarantee survival is to make it a worthwhile society. I think, for

example, that the main reason why the Russian threat is different from the way they were under Stalin, let's say ten and fifteen years ago, is because their standard of living has risen enormously. They seem to have many more consumer goods and they are just not willing to take a chance on destroying their whole society. This is what the Chinese have against the Russians. They say the Russians have become middle class. So my feeling is that it isn't obvious what the most direct route to pacifism is. Any intelligent, moral person must be against war but this is by itself sort of a meaningless statement. The question is what can one do constructively to be against war? It might very well be that one of the most effective ways to be against war would let's say, to recognize China. No, I am not advocating this. I happen to think it is a reasonable idea, but I haven't looked at it recently. There may be all kinds of political and economic and military reasons why we don't want to do it, but what I am saying is that it might very well be that something which appears quite tangential might be the most effective thing that a person can do. Most people think, when they say disarmament, that they mean unilateral disarmament. That hardly seems to be a very effective answer to war. I think the situation is just too complex. We need much, much more complicated approaches to the problem, and much more discussion of the systems aspect. The fact is that there is no central problem and there are no isolated problems in our society. Every problem intertwines with everything else so that what we do in Viet Nam affects what goes on in South America and Berlin and so on and so forth. This make life very unpleasant. It makes it very difficult to get into friendly arguments. When you're sitting around at somebody's house after dinner someone may make a comment like saying, "Why don't we just disarm". You don't feel like getting up and making a little speech like this, you see. In the first place, there's not even a pulpit.

Question: Are we not now training millions to expect to live luxuriously without work? In other words, is this not what some people are recommending in employment, that would pay them for no work?

Dr. Bellman: Well, there is a difference between paying them a minimum amount, let's say four or five thousand dollars a year for subsistence, and allowing them to live in luxury. In the first place, I feel again optimistically that the majority of people are moral, and that the majority of people want to work, even if they are immoral. I mean, both moral or immoral people want to work. The necessity of work is part of the vitality of the human animal. People don't just want to sit around and do nothing. There are always going to be a few people who take advantage of any system and any program but to assume that in any society there would be a large number of people who would enjoy doing nothing, is not a reasonable fear. I also don't believe in the guaranteed annual wage. I mean, I don't believe in both parts of the question.

Question: There is a question here on psychological testing for abilities and so forth. Do you think this current fashion will continue until an individual's future will be computer plotted from birth? In other words, in the book "The Vanishing Adolescent", it is pointed out that the teenagers are tested psychologically to death and they lose their individuality.

Dr. Bellman: I was under the impression that over the last five years there has been a tremendous counter attack against psychological testing. A number of good books have appeared just within the last year devoted to the fallacy of most of the tests. It's hard to find even a graduate student in psychology who will defend I.Q. anymore. I remember ten years ago whenever I was bored at a dinner party, I would always look around for somebody who was a psychologist and get him to defend I.Q. (I really recommend this technique. It keeps you from beating your wife. We all have a few pet peeves and if you just look around at a party for somebody who adheres to one of these and then turn to them very politely and needle them, it keeps you from getting ulcers and nervous tension, etc.) I think psychological testing has been discredited to an enormous degree. I understand that the government is retreating step by step. They are trying to get rid of some of these questionnaires which were a severe invasion of privacy. So there is a strong counter attack. I think it's a typical example of what happens when you bring something out into the open, and tell the average citizen what's been going on. There's a big reaction and something is done.

Question: May I ask then how we can mount the "counter attack" against such persons as a Henry Miller? The group which you mentioned.

Dr. Bellman: There are two good things about Henry Miller. In the first place, his sex is straight forward sex, no perversions and secondly, he did it for money. Now, this is a sensible attitude. What I object to about people like Genet and Leroy Jones and Tennessee Williams is that even if they weren't paid, they would be doing it. You see they are doing it to attack. There is a big difference and many of the critics have differentiated very clearly between the pornography of Henry Miller and the pornography of these other people, which they feel is much more insidious.

Question: How do we counter attack?

Dr. Bellman: I really haven't given much thought to the question. I think the first thing to do is to have discussions. For example, a very good symposium would be one devoted to just that question, you see. How does the middle class counter attack people

like the Genets' and Tennessee Williams', and a number of others that we could mention, that have been turning out these books and novels. I must say that at dinner parties I try to find somebody who is a great admirer of Genet and Williams, then I enjoy myself. This is destructive testing. I haven't any constructive ideas, and I wouldn't know how to go about it, but as I say, it seems to be that a symposium devoted to this question would be very interesting.

There was an interesting lecture at U.S.C. which had the title "After Pornography, What?" This is a very worthwhile question in itself. These people are bound to go in a different direction if only because they have sort of exhausted possibilities. I think artistically and from the literary point of view, we are in a transition period which is very hard as far as people who have grown up in one type of climate are concerned. What we will find, I'm sure, is that our children will have an entirely different attitude toward these four letter words. Of course, what is very unfortunate is that there are not that many curse words in the English language, and they are being ruined.

Question: Does the Rand Corporation make many paid value judgments on proposed national governmental programs?

Dr. Bellman: Yes, and that's their job.

Question: Individuality and spiritual values. Is individuality a spiritual value? How do you distinguish between the two?

Dr. Bellman: I agree very strongly that individuality is one of the most important spiritual values. I think that we can conceive of a system which will allow a great deal of freedom to the individual and yet the whole society would be pointed in directions that we would not be at all enthusiastic about. My feeling is that these interlink. I think spiritual values certainly transcend the particular problem of individuality.

INTRODUCTION

for

Dr. Carl M. York

For this evening we were extremely anxious to obtain a man directly and personally involved in "new trends in higher education". In contacting Dr. Murphy, Chancellor at UCLA, he felt that our speaker was one who was at the cutting-edge of the future of education and asked him to represent UCLA here tonight. He is the one at the University involved in projects of an extra mural and research nature. So often these lead to the new trends in subsequent curriculum.

His B.A., M.A., and Ph. D are from Berkeley. He was given a one year Fullbright Scholarship in England. He worked on his post doctorate for two years at Cal Tech. He spent five years at the University of Chicago Physics Department and one year at Geneva, Switzerland, "Center for Nuclear Research".

Our speaker is Assistant Vice Chancellor for the office of Research and Extramural support, UCLA, speaking on the subject, "New Trends in Higher Education".....Dr. Carl M. York

in the United States and especially the state of California, there has been a traditional commitment to provide equal opportunities for education for all who seek it. This commitment, when coupled with the growth of our population, implies that all of education must grow. However, this enforced growth contains, at the present time, a number of serious imbalances. Now as all the world the highly publicized discrimination between the educational opportunities of Negroes and Caucasians in the Southern part of the United States. A more sobering fact which is most less publicized is that, in the State of California, in spite of the low tuition rates and low cost of higher education, the number of students from upper and middle income groups is three times that of the number of students

NEW TRENDS IN HIGHER EDUCATION

by

Dr. Carl M. York

Higher education is in a state of extreme agitation and phonetic activity. Although most of these activities may seem randomly directed, there are at least two trends in the over all picture which play a major role in higher education and shall play a major role for years to come. I should like to concentrate this evening on these two trends in order to lay a foundation for the panel discussion which is to follow.

The first trend which I would like to discuss is the enforced expansion of higher education. The second is the role of research in higher education. My contention is that other matters which are highly publicized at the present time, student unrest, curriculum reform, the need for inter-disciplinary studies, publish or parish and so on, represent, for the most part, by-products of these two major trends. Before starting a discussion on these two trends, let me parenthetically inject my conception of the role of higher education in our society.

The obligations of higher education are three fold. The first, is to store the information and knowledge which has been acquired by mankind in the past. The second, is to impart that information to the students of the present, and the third, is to explore and expand the boundaries of present day knowledge and to re-examine the existing body of learning in the light of those in the explorations. With these three basic functions in mind, let us now turn to the enforced expansion of higher education.

In the United States and especially the state of California, there has been a traditional commitment to provide equal opportunities for education for all who seek it. This commitment, when coupled with the growth of our population, implies that all of education must grow. However, this enforced growth contains, at the present time, a number of serious imbalances. Now we all know of the highly publicized discrimination between the educational opportunities of Negroes and Caucasians in the Southeastern part of the United States. A more sobering fact which is must less publicized is that, in the State of California, in spite of the low tuition rates and low cost of higher education, the number of students from upper and upper middle income groups is three time that of the number of students

from low income and poverty groups. One aspect of the growth trend in our own state will be a concerted effort to encourage lower income groups to avail themselves of higher education. As long as this defacto discrimination occurs we cannot truly plead the case of equal opportunity for all. Until some measure of vertical mobility from lower to higher economic levels is a reality, we shall be plagued with desperate problems such as Appalachia, the Watts area, etc. It is widely believed that one way to provide this vertical mobility is to provide a ladder of education upon which all members of our society can climb with equal opportunity.

Fortunately, the Federal government has taken tremendous steps forward in providing this ladder. Under the terms of the higher education act in 1965, one of the avalanche of legislative bills passed by the 89th Congress, for the first time under-graduate students, economically deprived, will be able to receive direct Federal scholarship support. However, no one can believe that the problem is so simply solved, because the lower income student has already been placed at a serious disadvantage in applying for entrance to a university by inadequate elementary and secondary education. The unbelievably perceptive 89th Congress has foreseen this aspect of the problem too. Its solution is couched in the elementary and secondary School Education Act of 1965. This formidable piece of legislation channels federal funds through the state boards of education to the various appropriate school systems at the elementary and secondary levels. The profound affect of this legislation coupled with the higher education act in its provisions will probably not be felt for perhaps five to ten years. However, it is my belief that this educational legislation will do as much, perhaps even more, to provide equal opportunity for all than the loudly heralded civil rights legislation of the 88th Congress. The first aspect then of the growth trend in higher education, which I would identify from this discussion of the federal legislation, is that the university will see in the coming years the realization of equal opportunity for all in higher education.

The second aspect of the growth trend in higher education is the need to meet certain demands of our society in the area of highly skilled technological training. From the preceding days of this Symposium in which experts have discussed such titles as "Technology of the Future", "Synchronous Communication Satellites", "What is a Computer?" and so on, it must be clear to you that one needs a rather high degree of education of an extremely specialized type to even converse about such matters, much less understand them. The problem for higher education which is implied by such developments is two-fold. First, it may be necessary to extend the period of training of a student in order to provide the proper preparation for him to take his place in our technological society. For example, engineering schools all over the country are discussing a five-year program instead of the usual four-year program.

The second part of the problem is the obligation of higher education to provide retraining or up-dating types of seminar courses very much the same as the theonetic symposium you are engaged in here. We are describing the function of adult education and more specifically in the state of California, the University of California extension program. I hasten to add here, this is not an advertisement for my professional affiliation. I shall not dwell on the subject of education in the extension division, but would simply comment that this year some 200,000 adults in California are involved in this type of retraining activity. Because of the rapid changes in technology, which not only produces the need for retraining, but provides more leisure-time for adults, it seems perfectly clear that this second aspect of the growth of higher education will be an insistence upon a continually increasing program of adult education throughout the entire country.

To discuss the growth of higher education without mentioning a few of the problems concerned would be to ignore the most publicized part of higher education today. My terminology in the preceding discussion is exactly what offended so many students in the large universities across the country during the past year. They correctly claim that they do not wish to be looked upon as the output or end product of a large educational factory feeding the market of technologically oriented industrial consumers. While I can certainly sympathize with their individual response to this demeaning terminology, I do not personally treat my students in such a crassly commercial fashion. I find it extremely difficult to reconcile the problem of growth implied by the commitment of state and federal governments toward education, without falling back on the vocabulary of a pseudo industrial manager. The greatest abuse suffered by the student is not the use of an IBM card or machinery to carry out the the extremely complicated mechanical operation required to cope with a class enrollment of 27,000 students in a period of three or four days, or the complaint about the harsh realities of the proficient managment this operation brings about, but rather, the difficulties center on the techniques used with the handling of human beings. Now these are the same problems the pastor has of any large congregation. These are the same problems the city government has of a huge urban metropolis. Simply stated, the common trouble lies in the fact that those very mechanisms, which are required to deal with large numbers of people, are basically non-individualistic. It is my firm conviction that in handling large congregations or large groups of students, it is possible to communicate successfully with the individual and to respond sensitively to his legitimate needs. Furthermore, I am convinced that a great deal more effort in this direction must be expended by the universities and other institutions of higher learning in the future than has been spent to date.

One of the aspects of this problem of coping with the masses, which seems not to be generally appreciated by the public, is the carefully

constructed framework of higher education in the state of California. Most people are dimly aware of the Donahoe Act of 1960 passed by the state legislature, which sets forth a master plan for higher education in the state. What is little understood by the public at large, are the provisions of the Donahoe Act and the details of the structure which already exist to meet the needs of this plan. Under this master plan, the University of California serves a very unique function. This organization is charged with the sole responsibility for carrying out graduate education and professional training as well as for performing research. To carry out this research and training function, the Universities have been of necessity, rigidly structured to accept and train students who know exactly which field of specialization they wish to undertake for a career. At the undergraduate level it is possible to obtain a classical liberal arts generalized type of education, but the University of California is not really structured in such a way that this can be easily provided. The Donahoe Act has made a vast provision for those students who wish such a general education or who are uncertain about their chosen profession.

The state university system coupled with the state and junior colleges enable a high school graduate to obtain a diversified education for either two or four years at the usual modest cost of state supported education in California. If at anytime during the student's career he desires to undertake a field of specialization, he can simply transfer to the university where he can then pursue his goal to the outer most boundaries of knowledge in that field. Unfortunately, the snob appeal of the University of California in all of its nine branches is very great. There is tremendous social pressure put upon many of the students who attend the university, whether it provides the type of education that the individual needs or not. It is this basic misunderstanding of the role in the various institutions of the master plan, plus their rather specialized structure, that I attribute a great deal of the so called student unrest; the burning in effigy of IBM cards; the publisher parish debates and great number of similar publicized items. In many cases the students are simply attending the wrong campus for the wrong reason. Now please don't misunderstand these remarks. They are meant to convey some degree of insight into the structure of higher education under the master plan in this state and are not to be construed as a defense of the appallingly poor handling of students by the staff of some of our campuses.

Let us next consider the second major trend in higher education, namely, the role of research in the university. The University of California is charged with carrying out research as well as the graduate education and training in the State of California. It should be understood that these two are inseparable. At the beginning of this talk, a statement was made that one of the three major obligations of higher education was to explore and expand the

the boundaries of present day knowledge and to examine the existing body of learning in the light of these new explorations. Now this statement might be taken as a definition of the research function of the university. There is one aspect of the role of research in an American university which is historically unique to this country and I think is not widely appreciated. This is the concept that research should be performed as a public service in an institution of higher education. Let me trace the history of this concept of research.

The original Land Grant College (Morrison) Act of 1862 established the land grant colleges in every state and carried with it, not only the gift of public land to establish colleges, but also a definite commitment of those colleges to public service. When one stops to consider what the Congress of 1862 must have had on its mind in addition to this act, it is truly remarkable that this type of legislation was undertaken at that point in history. Part of the program under this act established colleges to carry out research for "agriculture and the mechanic arts" and to disseminate the information by teaching the population the results of this research. Later on the remarkably effective farm programs guaranteed the dissemination of the information obtained from agricultural research; both by established federal research laboratories on the campuses, called agricultural experiment stations, and by establishing a network of county agents to act as liaison officers between these research laboratories and the farmers whom they serve. It is tempting to suggest that not only was this program the forerunner of extension education of the adult public, but that it set the stage for federal and state cooperation with the universities in research.

During World War I and in the earlier wars of our history, modest attempts were made to mobilize scientists to solve the technological problems of warfare. However, as you all know, it remained for World War II, with all the power and horror released by the atomic bomb, to establish the connection between scientific research and federal support in the minds of the citizens of this country. Again I emphasize, that on the part of those university staff members engaged in the Manhattan Project which developed the bomb, there was a prevailing note of public service underlining all their activities. It has been well established and well publicized the rapid growth of the federal commitment to support research in the universities since the end of World War II. I have suggested in preceding discussion regarding the enforced growth of higher education in general that the support and growth of research in the universities is not only appropriate to the university's role in higher education, but that such growth is essential if that role is to be fulfilled. One unusual way to regard the support of research in the university is to say that the federal government is blindly seeking some means to support higher education, and not by social or political acceptable mechanisms.

For years the spectre of federal control in the minds of our nation's youth has haunted the whole relationship between the federal government and the state supported schools. If the 89th Congress displayed true genius and courage, it was to evolve a satisfactory mechanism of federal support which simultaneously avoided the evil of federal control. My point is, that this mechanism which is included in the various education acts referred to earlier, has been actually tested in one way or another in the past 100 years. It is absurd to suggest, at this point in history, that universities should not avail themselves of federal support for research. Many of these schools, including the University of California, which is the land grant college of this state, would not even exist had it not been for the federal government's support over the years. The problem has been to establish means by which the privately endowed colleges and universities could also partake in federally sponsored research in a mutual way. This has been accomplished in the post World War II period. Furthermore, all of these institutions who have undertaken to carry out this reasearch have greatly benefited.

Senator Royce of Wisconsin, held a detailed congressional investigation to examine the affect of federal research money in higher education. Congressional concern for this relationship has been in evidence during the past few years and has become more and more active. Taken at face value, however, the Royce Report is somewhat self-contradictory. Most educators agree with the recommendations of Senator Royce, but the excerpts from the testimony which have been published are frequently taken out of context in which the testimony was given. This has led to the apparent contradiction and is a result of the unfortunate job of editing the report by the staff of the senate committee. From the testimony given, it is perfectly clear that the universities and the scientists in the universities, were able to obtain federal funds for research just after World War II were surrounded by what can be best described as an aura of infallibility. There was little or no auditing required on the part of the federal government for these funds and their use. The professor in some cases switched his loyalty to the federal granting agency and away from the university thereby proving its fallibility. A remarkably small number of cases involving improper use of federal funds have come to light in spite of enthusiastic congressional investigation. This again indicates that the scientist is a human being after all, but a relatively honest one.

Needless to say, the tax payer deserves to have his dollars spent in a more conventional fashion and there has been a continual tightening of the restrictions placed upon the use of federal funds by the universities. The students who are as vocal on this matter as in every other matter concerning the universities have seized upon research in the universities as a whipping boy to vent their frustrations. Again, there is certainly some truth to the complaint that federal monies take the scientist out of the classroom, but the fact that the same scientist may have moved into a laboratory with his

graduate research students is, of course, never publicly mentioned. The students also never mention that the snob appeal for themselves at a given university was based largely upon the research reputation of the faculty of that university, nor do they face up to the fact a man cannot truly excel in his research if all of his time is spent over coffee in the student union with the students. In spite of the student's efforts to flog this whipping boy, I see no trend whatever away from research in higher education and have, in fact, observed just the opposite. Again, however, there is an obvious requirement to meet both the human needs of the student and the professional needs of the research oriented professor.

A more serious problem for the university than the research-minded professor, is the inequity of federal funding between the fields of research in any large university. One can hardly justify in the national picture the research funds of the past few years. Federal funds were supplied 65% of the time to the physical sciences, 25% to the life sciences and health professions, 10% to the social sciences, and nothing at all for the arts and humanities. Again the 89th Congress has come through like the cavalry to rescue this situation. The National Foundation for the Arts and Humanities have now established a means by which the balance in funding can be restored in the university. Thus the trend of higher education certainly seems to be one of continuing emphasis on research and creative endeavor despite the under-graduate students protests. This research will hopefully have a much more uniform distribution of federal support funds according to the various field within the university. There will be an even closer relationship established between federal government and the institutions of higher education in this country. This relationship will be based on the mutual needs of society as a whole and the inherent prerogative of the university to retain and maintain their intellectual freedom and independence. There is every indication that this happy balance can be achieved and maintained even during the excruciating period of rapid growth and expansion which is clearly coming.

In conclusion then, let me summarize the trends in higher education which I have described. First, that higher education will continue to grow at a very rapid pace. This growth will be characterized by more equal opportunity for all to receive an adequate education. There will also be an increase in adult retraining and recreation programs. The second trend, the research function will continue to grow and flourish with the aid of federal support in order to supply the increasing demands of our society.

NEW TRENDS IN HIGHER EDUCATION

by

Dr. Carl M. York

Question: With the new trend for research monies in the arts, and this general area, what are the statistical balances to be foreseen in the future with respect to technological grants and those in the liberal arts area? This is asked out of the content of the theonetics symposiums where there has been stress laid on the fact that the areas of the humanities must inform technology about a direction.

Dr. York: Dr. Bellman in a previous address here gave an ardent plea for the imbalance of funds which I described. The statistics that I gave were 65% into the physical sciences, 25% into the life sciences and medical professions and 10% went into the social sciences. Nothing went into the arts and humanities. I put that in the past tense. Last year when the Office of Economic Opportunity was established, there were a number of ways in which research programs could be established in universities in the social sciences, so that I think there was a relative shift that increases up to 15%, as the result of one year's legislation. There is, under the new aid to education act and the Elementary and Secondary School Act of 1965, provision for actually doing education in fine arts and in the humanities. One of the programs which might be of interest here is that there is a program under way to be applied in the Southwest. There is a Southwestern consortium of the Southern California Schools. Arizona and New Mexico and perhaps Hawaii will come into it. This is just in the formative stages. There is going to be an experimental program started to actually teach the fine arts, namely, music, painting, sculpture and theatre, by sending groups from the universities that have fine arts colleges, such as U.C.L.A. Our college of fine arts at U.C.L.A. is deeply involved in a proposal to set up this program. For example, they will teach Shakespeare by having a troupe of players go and perform a Shakespeare play for the young kids, but they will perform the play and let the students get the full dramatic impact of it, rather than reading it out of the dry and stuffy books. There will be young performers who will be sent on tour of the elementary and secondary schools. There will be traveling art shows. Presumably these shows will be traveling shows which will be shown in the school auditorium. They will be very carefully put together by the art department of U.C.L.A. They already have such a program right now and it has been privately funded to date, but the federal government has now begun to participate.

So what I am saying it's hard to predict what the shift will be. I think it will be out of legislation which is basically social, namely the education act, but I think it will have a tremendous effect on the arts and the humanities. I hope it will.

Question: Does the University of California expect to become all upper grade level by a certain year?

Dr. York: The freshman and sophomore year are called lower division in our jargon, the junior and senior year are called upper division. Now, I think what the question means is, are the first two years of college to be phased out. The answer is no. Not at U.C.L.A. and not at Berkeley. Other campuses are still too small to worry about it. As you know the Berkeley campus arrived at the magic figure of 27,500 last year. U.C.L.A. THIS YEAR has 25,500. Berkeley lost a few. It lost over a thousand. It is down to 26,000. So the two schools are very comparable. In our master plan for the enrollment there is an imbalance in the graduate and undergraduate training, the steady state as we go through a transition, if I may use the mathematical jargon. In about 1970 we will have 12,000 graduate students and the remaining 15,500 will be undergraduates. There is at this time no foreseen cutback in the lower division enrollment. I don't work with the normal distribution of freshmen and sophomore, but at the present time, until 1970, that is not foreseen.

Question: How much revenue comes to the university by way of private industry?

Dr. York: May I again qualify the question by speaking for U.C.L.A. in Westwood and not the university in the broad sense. At U.C.L.A. something on the order of \$50,000 comes from industry. The expenditures of extramural funds this year were \$38,000,000. Most of those are from the federal government and from private foundations. We have a lot of Ford money and Carnegie money, but the local industry supports almost nothing.

Question: How do you provide motivation to bring in low income groups to be educated? What are some of the barriers that keep these people from coming in?

Dr. York: I think that the hope is based on a number of experiments which are not loudly talked about in the federal government. Let me tell you the results of a Ford Foundation financed study which was carried out in East Los Angeles some years ago. They took two groups of the Mexican American children who live in that neighborhood. One was the usual control, they did nothing with them but observe them and catalogue them and did whatever social scientist do with them. The other group was given one satisfactory meal per day during the school year. They did the whole battery of psychological tests. In the age group three to six the apparent I.Q. doubled by giving those children one square meal a day, given at the lunchtime. If you waited until the age of seven to ten (I think this was the other pair of groups that were tried) and then you again gave them one square meal a day, there was no observable change in the I.Q. as measured. Now there are a couple of factors that I can throw in, and I'm not a sociologist. One of the factors was that with this younger

group of children they actually took them out of the family situation. This breaking the family goes against the grain of the classical thinking, but in the family situations here, the mother and father were never present, it was always the older child (namely two or three years older in most cases) who had the supervisory control over the child. There was no stimulation on the part of the child to achieve anything better than two years older than himself, and it was this fact which was attributed to the sort of killing of I.Q. However, when they took them from the home, put them in the school on a regular basis, fed them regularly, (the feeding is not irrelevant because the child has a little more appreciation of life apparently when he's not so hungry) they would put the child in a challenging and motivating situation. The natural response of the children seemed to be that they would aspire to achieve higher goals. They were not so suppressed by not having anything like an older brother or sister to cram them down into the mud.

Well, as I say, I have only heard that that is only one argument for the first part of the question, how do you motivate children.

Apparently with the true poverty groups here in Los Angeles we may not have tried hard enough just with the food program, I don't know.

The second one is what are the barriers to their coming in. In trying to build the southwestern regional educational methods laboratory we are trying to stimulate the child to try to achieve by exposing them to something other than the awful TV programs, which they are clearly exposed to. Now what are the objections. Already I have said one of them. One of the objections is that to do this in the poverty stricken groups you may have to break their pattern of family life. I think that's a problem for you gentlemen to think about.

I think that there is also a good deal of problem here in the city of Los Angeles just to get everybody to sit down to talk to each other about their problems. You read the paper about Mayor Yorty's trouble with "should there be a poverty stricken member in the group of people who hand out the poverty funds, and so on and so on." I think those are mechanical problems. I think there are some social issues at stake that should be considered by the electorate, who are those of us in this room.

Question: Is it your opinion that the administration should direct the course and the curriculum of the university making major decisions, or should the professors and students? Now along with this there are two examples: (1) to avoid any control by industry and business who want certain types of people turned out and the other is (2) the public pressure through the California state legislature affecting academic freedom in the university. Who is going to be responsible, in other words?

Dr. York: Let me clarify the first part. I know of no school, no institution of higher education in this state, nor do I know of any in the country, who do not have the faculty set

what the curriculum shall be. The argument there is somewhat self-evident. These are the men you have hired as the experts to teach. If they don't know what to teach how can they be experts? The faculty at U.C.L.A. always has and shall continue to say what the curriculum is.

As to the second part of the question. Certainly business makes a rather minute contribution to the state university, located at Westwood anyhow. I think that should be changed. I think that they have everything to gain. They do have very beneficial fellowship programs that do help individual students. (I was talking about monies being made available for research when I quoted figures earlier). The answer I would give is that if the administration has the intestinal fortitude to do its job properly, then those pressures that may come with the money can be resisted. One of the great strengths of the University of California and some of the greatest attractions it had for me was the fact that it has a rather unique system regarding the connection with the state legislature. As you may not know, the regents of the University of California are actually a governing board of a public service corporation. It has it's own special treatment in the state constitution and that's as it should be too, I guess, but functionally the university proper, that is the campuses, are protected from the direct state invasion by the regents. When I was a student the Tenny Committee was a very popular committee. This was years ago. Tenny also ran the legislature's un-American Activities operation. Clark Kerr was like a vice-chancellor, only in those days the titles were different, but the functions were about the same. The committee did investigate the Berkeley campus while I was a student there. It was rigorously handled by the university administration because they had the courage to stand up and make sure that the student's rights were never violated, nor the faculty rights violated. They had the university lawyer present to protect their organization. Since that time that's not always been true. I think that since the tax payers of the state support the university, the tax payers and their representatives in the legislature have every right to make any kind of investigation they want, as long as the administrators in university campuses protect the individuals involved. I think that that is their responsibility. I think you are in a situation where you can't say "no" to an investigation of any kind.

Question: In this age of complexity is there a place for flexibility in the student? Should we help our students specialize, or do we discourage them?

Dr. York: Not every freshman who walks in the door is ready for graduate work, although there are a large number who suggest that they are. They usually have to serve a sort of apprenticeship, through the school of hard knocks, in the freshman and sophomore courses. At U.C.L.A., for example, there is a course that

is normally reserved for seniors. It exists in almost every department that I know anything about. It's called Undergraduate Research, in which you go to a member on faculty and you ask him if he has a research project which you could do under his direction as a form of independent study. Some juniors are allowed to take this course. They look to see whether you can do anything very constructive in this. I think that is always the criteria. Has the student had the background to be able to really begin to take up (A) a large amount of the faculty member's time but (B) can he really accomplish anything that will be satisfying and rewarding to him in his education. My own feeling is that if somebody wants to do something let him go on and specialize to his heart's content.

We are going from the semester to the quarter system next year. It's going to be an awful mess, but in doing that opportunity was taken to restructure all of the curriculum, usually to harden a core in each major and make it smaller in the number of required units to be taken. The others are free electives. The system is fiendishly rigged so that the student has to take an incredibly wide gamut of courses. The complaint normally is that the student has to take all of these terribly unpleasant grind courses to meet the American Institution's requirement for English, which incidentally most of them need. Hardly any of them speak or write English.

The professors worry about spreading those students too thin. I think that they are forced to spread themselves out too much. The dedicated sole who wants to be the greatest composer of music is not allowed to take his music courses. He doesn't want to take math, science, English and so on. What happens is that he is a frustrated soul more often than not because he wants to concentrate more than the system lets him and then that's when the trouble starts.

Question: At a student faculty symposium my freshman son attended, it was strongly urged by the faculty members that entering freshmen should not come to the university with a declared major. What trend is this?

Dr. York: I think if he doesn't, he is apt to get lost and frustrated and the whole education experience will be a defeat for him.

Question: Is there a noticeable trend toward greater social and political awareness in the students, or is this just a passing phase?

Dr. York: I believe that there are sophisticating influences in the lives of children today, such as the television, for better

or worse. They are much more aware. They are bombarded by the mass media, but also it is of thoughts and ideas. Certainly when I was going to school we had to dig them out. We had to stop and read the newspaper. Now this bombardment starts when they are very young. I think one of the big problems about where we are going and where we will arrive stem from the mass media, their role in our society and the effects they have.

Question: How would you evaluate the role of a small church related college relative to the trends that you have defined?

Dr. York: My entire talk has been directed toward schools such as U.C.L.A. I would say that there is a tremendous need for small liberal arts colleges with religious affiliations. I think there is an enormous need. It's not too difficult to remember when you were a student or even if you didn't go to college when you were between 17 and 20. That is a very important time in life. It was a time in which you left your home and probably went away to school, or you didn't leave home and you went away to school. (Incidentally - 60% of our undergraduate students come from within five miles of the Westwood campus. They live within five miles.) Eventually you left home. Now that's a period of great crises in people's lives, I think. Depending on what kind of a background the individual's preparation for it, it can be either blessed or it can be very harrowing. I am suggesting that it can be like sending an unprepared child to a city like New York (although U.C.L.A. is not quite that big yet). He might easily get lost. It seems to me that there is always a question of where do you send him. I think you have to judge the maturity of the child. I'm sure that many of the pastors in the room are questioned by the people in their congregations as concerning John's readiness to go to college. I think that's one of the most important questions people can ask. I am convinced that a small religiously oriented college has an incredibly important role to play in making the transition from home to the outer world. To make it a viable transition rather than something that is completely defeating to the student, making it possible for him to successfully go on and pursue his later goals. He may from that school go to a graduate school and specialize.

INTRODUCTION

for

J. Curtis Counts

Part of today's reaction to the world and its changing character is in the field of labor-management. Our original plan was to have a Union President discuss the Union side of work in an automated society, and have our speaker discuss the Management side.

I have been in communication with Walter Reuther since last July and we had every hope that he would come, but pressure of business caused him to finally have to back out, and we received his telegram canceling, just three weeks ago. I then called Ralph Helstein (whose superb article was in your packet, he is President of United Packinghouse and Food workers located in Chicago). He was most anxious to come, but his schedule would not fit our schedule so we plan to obtain him for a later symposium.

So our speaker, by virtue of being on the National-Labor Management panel (appointed by President Kennedy), seemed to be one who could fill both spots.

He is also a member of the Pacific Coast Manpower Advisory Committee, appointed by Labor Secretary Wirtz.

He joined Douglas in 1941 after graduation from UCLA and has been in the personnel side of the business ever since. In 1948 he became Employee Relations Manager, and in 1960 was named Assistant Director of Industrial Relations, and appointed company director of employee relations in 1962. In August of 1964 he was named Vice President, Employee Relations, Douglas Aircraft Company.

His subject, "Management and Labor Relations in an Automated Society"
....Mr. J. Curtis Counts.....

MANAGEMENT AND LABOR RELATIONS IN AN AUTOMATED SOCIETY

by

J. Curtis Counts

I have come here today not as an expert in the field of automation or in the technological process of automation, but as a representative of that segment of management that has to do with the people's side of the automation process.

Few words in recent years have been so twisted to suit a multitude of purposes as the word automation. It has been a rallying cry for technology. It has been a manufacturing goal. It has been an engineering challenge, an advertising slogan, a labor union campaign banner and, most of all and most importantly in my opinion, a symbol of unanimous change. It is disturbing to realize that the term automation or innovation is used quite popularly to mean anything that causes unemployment, when in reality automation is nothing more than increasing efficiency through technological improvement.

Many of you have probably heard the story told by the executive vice-president of US Industries about the sidewalk superintendents who, many years ago, were standing along side an excavation watching a steam shovel excavate for the foundation of a large skyscraper. "The same of it" said one, "That machine with one man in the cab is doing the work of a hundred men with shovels." "Or", said his friend, "of ten thousand men with spoons". I think this conversation is pretty apt because it points out two rather important things. First, automation, or innovation, or mechanization DOES replace men with machines. I don't think there is any question about that. Secondly, though, it has been responsible for much of America's economic progress for our industrial leadership and for our high standard of living. I am certain that the construction boom which followed the innovation of machinery in recognized processes certainly is evident of the fact that it does create industrial progress and it does enhance our standard of living.

As people who are interested in the people or human relations side of religious, business and industry organization, I believe you should be as much concerned as I am about the misconceptions, I call them "miss" that are associated with automation. What I thought I would do this morning is to discuss briefly three or four of these popular misconceptions; then talk to you about some of the things that government, labor, and management is doing to provide jobs and job skills for those who do not have them. It is my hope that by this type of discussion I may stimulate some questions, and if I can, we will have

profitably spent our time.

The first misconception I want to visit with you about is, the popular belief that automation is a totally new problem, that it only began yesterday. To take an example from the very beginning of automation, you know that the industrial revolution started when machines replaced handcraftsmen in the 18th century in the English textile mills. Workers at that time thought the machines were a threat to their jobs. They lacked the ordinary grievance procedures that we have today, so to alleviate their condition they organized themselves into secret bans and sabotaged the machinery so they could assure themselves continuance in their job. This so irritated the employer that they called upon the government to help them. Unfortunately they shot and killed many people and the employer who called for help was murdered resulting in hangings and exiles. Despite this rather morbid beginning, the word and the concept of "automation" has burst upon our present day scene with an emphasis that has never been experienced before. I don't think this is any small wonder when you consider you are living in a period when 90% of the scientists who ever lived are on this earth and alive today. These are the people who are leading the technological revolution which is smashing one scientific barrier after another.

John Snyder, president and chairman of the Board of US Industries and an individual who has done a good deal in this field, describes the pace of this change this way. I would like to read you this:

"Many of us fail to understand the nature and extent of the thrust of this technological revolution. Change can be measured in orders of magnitude meaning a factor of 10 times as much. It is a common observation that a change of an order of magnitude produces entirely new affects. Jet planes are about one order of magnitude faster than the first airplane. Missiles are at least 2 orders faster. Automobiles are one order of magnitude faster than a horse and wagon. The computer, which along with automatic machinery makes up an automatic system, is in its processes 6 or 7 magnitudes faster than man."

In a recent statement Steel magazine had this to say,

"Never before have our readers, metal working executives had as many choices, as many ways of doing jobs as they have today. It has been said that more progress has been made in the last 25 years than in all the ages before them. It has been said so many times that it is almost trite. But with no qualms whatever we can predict that in the next six or seven years more progress will be made in industrial technology than in the past 25 years or than in all preceding history."

Beyond a doubt these statements affirm what we already know. Automation is here. It is a very real thing. It's pace is increasing. Machine

power is being substituted not only for manpower but in many areas for brain power.

But the point that I want to make here is that this is not really new. We have had substitution or replacement occurring since the invention of the wheel. That is a trite statement, I think you can go back to the times in which man had no language and then the communication process began and we had translation and then we had writing and then type and linotype and the automatic type setter and that sort of thing. Now all of these things have developed and all of these things undoubtedly have replaced people; but at the same time we could probably venture a sound guess that we have more type-setters working today because of the number of communications and the kind of communication media that we now have today than we ever had during the days of the translators. I think the only thing that is different about this process today is the pace of it. Because the pace is so fast, confusion surrounding it has expanded geometrically rather than arithmetically. I think we are in a position where we should expect an even more rapid pace of development within the next five or ten years ahead.

Another misconception we have today, is the idea that automation's sole purpose is to displace people. For example, the claim is made that automation or technological innovation is the major if not the sole cause of unemployment. Al Hayes, who preceded Roy C. Miller as president of the International Association of Machinists was one of those individuals who argued very strongly that automation and technological innovation reduced job opportunities. There are other individuals (Henry Ford is a good example) who argue quite strongly that automation does not and has not reduced employment. It is a job-creating device. While there is no accurate device known to me for measuring the impact of automation upon employment, I do think that today's employment figures indicate that the impact, be it good or bad, is not as people would have you believe. The latest figures from the Bureau of Labor Statistics regarding employment indicate that today, right now, we are approaching a period of labor scarcity.

I think it would be interesting for you folk to know that as of this October, 1965 there were 76 million people in the work force. Think of 73.2 million of these within the definition of employment used by the Bureau of Labor Statistics as employed. 2.8 million were unemployed. On unadjusted employment rate this is about 3.6%. The figure that you will see in the paper which is a seasonally adjusted figure and which is intended to relate October to October will show that the adjusted figure is 4.3%. Significantly, of the two million that are employed, one million of them are male adults and a male adult is defined as a male, the age of 20 years or over. Another one million of the 2.8 million unemployed were female adults, again 20 years of age or over. eight-tenths million, which by the way of percentage, is 13% of the total, were teenagers. Now you can quarrel with these figures and I do not give them to you as gospel.

I know when you get into many of these problems that have to do with minority groups and that sort of thing the argument is always made that there are unemployed that are not in the work force because of the despair and the hopelessness that attaches to seeking jobs and that sort of thing. But I do think it is significant to look at these figures and read from them a couple of things. I think that it says to us quite clearly that as of today there is a real scarcity of prime workers. I can certainly say that this is true in my business, which is the aerospace business, where we have jobs going begging for want of people who are qualified to perform them. I think that it also indicates that the large number of teenagers unemployed, plus the projection of the Department of Labor, that there are going to be 3 3/4 million teenagers added to the work force annually each in the next five years, indicating that we are going to have a great supply of new workers and indicating that we are certainly going to have all the problems that go with creating opportunities and matching these individuals with skills to the opportunities that exist in our economic structure.

I mentioned it briefly that while I hold no brief for the fact that automation is a known creator of jobs, I would like to point out that in our aerospace industry, which is the largest employer today, I don't think it would be possible for us to be in that position if it were not for the computer systems that we employ and in providing our various space and other missions. There just aren't enough human calculators to handle (in the time required) the computations that are required in a single test flight or a single placing of a satellite into orbit. On the other hand, if you do go into automated processes and you do not expand your national output so as to create new job opportunities as fast as the labor force grows, then you are going to have unemployment. If their automated processes also are devoted mainly to reducing costs so you don't have an increase in production in proportion to the increase in population growth, you also can have unemployment. I have said before and I will repeat again the fact that automation will displace people from jobs is indisputable. But the questions that we need to consider are whether or not there will be other jobs and whether or not the workers displaced can fill these other jobs. The rate of introduction of automation into this process is, of course, crucial and I think the thing that must be done is to introduce these changes in such a way that we can meet the problems of qualifying the displaced people or maximizing the qualification of displaced people for placement in these jobs.

Another popular misconception relative to automation is that American industry has a choice of whether to automate or not to automate. I think for most managements the decision to automate is a clear cut one. Businesses which are bedeviled by rising labor costs, by shortages of skilled laborers, by lack of capacity to handle demands, by poor product quality, have almost forced the use of automatic equipment if they are to remain in business. In a company where your production consists almost entirely of short runs of various items where both the volume and the composition of demand are sharply fluctuating, where the ability to use mechanization is at a low level, where you have a lot of hand operations and things of that sort, the question of automation may appear ludicrous. Another thing, considering you are pressed for funds, then

automation is an expensive process. It probably will be the last thing that appears on your list of things to do, but for most managements, it is in my opinion that in order to remain competitive in today's economy, each industry must use mechanized processes if industry is to survive.

Now another misconception and a popular one surrounds the idea that automation is rigidly and unalterably opposed by the employee, by his union and by most of the general public. This popular misconception bothers me because it seems to me to be especially defective. Certainly those of us who form the society, benefit from these changes and I think all of us are surrounded by the many devices automated, if you please, developments that have improved our standards of living and are typical of our everyday acceptance and our everyday wants. Certainly the representatives of the employees, the enlightened unions, recognize and have accepted the fact that automation is with us working diligently, making great strides, and contributing greatly to working out many of the problems that surround innovation.

I know you can point to the railroad unions, you can point to the typesetters as examples of unions, who have fought a continuous battle against automated processes. This morning reading the paper I saw a full page ad advising everybody that the number of railroad accidents had increased because of the elimination of firemen from railway crews. I think you have to recognize this, and I think you have to recognize that there is a lot of personal benefit and personal gain and a lot of selfishness involved in these attitudes.

Enlightened unions, such as the Machinists have worked out a plan with U.S. Industries. We have mentioned the Auto Workers, certainly the Packing Workers (and I am sure if Mr. Helstein was here he could tell you some interesting things about what they have done about the Armour experiment) and many of the things the union has done to meet the challenges of automation. But the fact of the matter is, that automation is with us and your enlightened unions do recognize that they are working with enlightened managements to solve this problem which is also social as well as economic.

As for the employee, I don't think he is any different than you and I are in our attitudes as a consumer. He is interested in what happens to him and he has a definite reaction to change, but his primary concern is in his own livelihood, his own self-preservation and what he is truly concerned with is some reassurance that his skills still remain marketable. If they don't remain marketable then he has an opportunity to transfer these skills or that if he has neither a marketable skill nor the opportunity to transfer them within the industry then he finds he does not have some financial income or some ability to sustain himself during periods of unemployment.

Now these four misconceptions I have spoken to you about are pretty elementary and pretty general, but I did this for a purpose. I hope that this gives you an idea of the 'people problem' that surrounds this problem of automation as it affects labor and management and government in its day to day operation.

What I would like to do with you now is to visit about some of the things that are being done in this particular area to meet these problems and hopefully touch upon some subjects that may be of interest to you and certainly are important to your understanding and counseling with people.

First as to government. The President's Advisory Committee on Labor and Management policies in 1962 made some recommendations that I think are particularly apt. Now much of industry disagrees with some of these things, but these are points that I think are important if we are to get into this problem of handling innovations. The first thing the government must do is to adopt policies which will promote a high rate of economic growth and full utilization of resources. Henry Ford, in his dissent to this recommendation stated clearly that the government's function is not to create jobs per se, in that it cannot create jobs per se. Well, this may be so, but such things as the tax reduction that we had is an idea of stimulating the money and the purchasing power of individuals to buy into the economy and to move so that you can create jobs and create the opportunity to work. These statistics I mentioned before show quite clearly that the real spendable income of employed people has the greatest increase that it has ever experienced in the last twenty years as a result of the tax cut that we experienced recently.

I think probably the most important function that government can do to help us meet the problem of automation is to assume the responsibility of collecting, collating, and disseminating information with present and future job opportunities and the requirements of a rapidly changing society. It is real important that we convey this message particularly to the youth so that we can counsel with them, we can qualify them, and we can bring them into the work force in a condition in which they can be qualified to make a contribution. Now there isn't enough of this being done and this I think is one of the very real weaknesses in our system. It isn't just government's job. We in industry have a real responsibility to make known our requirements and certainly enlightened managements are cooperating with such agencies as the Employment Service and others to get this done.

Let me read you four or five points out of this report that has to do with supporting and cooperating with industry and education to the end that new entrance to the labor force will be better qualified to meet the the occasional demands of the future. First, the Man-power Development Act, Job Corps, the War on Poverty, the Peace Corps, all of these are extensions of this idea and we are getting training done. We are getting people learning how to read and write for the first time as a result of these programs.

Secondly, to cooperate in reducing the drop out rate of grade and high school levels. One of the things that is being done here and one of the greatest tools used by government and management, is to use individuals who have come out of a minority group or have come out of a depressed area or who have come out of a beginning that lacked the benefits of education, and who have become successful, by bringing them back into the schools and into the view of the people who find themselves in this position today so that opportunities can be created. This is really projecting the image.

A third, is better vocational, technical and guidance programs that must be made available. This is very important and you people who do so much counseling need to know again what the job requirements of today and of the future are. We don't have enough counselors in my opinion in our educational system and we do not have enough opportunity for those counselors to keep pace with what is going on. One of the things being done throughout Southern California and other areas is to provide the opportunity for counselors to work in industry during vacation periods and to visit continuously throughout the academic year to see the changes that are occurring technologically and otherwise and the requirements that must be developed. There are job characteristics, job ability and job skill inventories that come out much like a dictionary that are kept current, now being used and are very helpful in this particular area. Another thing is to provide better service to rural and depressed areas where surplus workers reside. We in the Douglas Company have had direct experience with this and I think it is one of the better tools the government can provide. Many of the states are providing tax opportunities or breaks to attract industry to come to their state and to bring business there. Favorable utility rates and other inducements attract industry. One of the things we did in the Appalachia area of Tennessee was, instead of building a facility in one city, we built satellite facilities in five different locations in the state and in the center of the satellites we put an assembly facility. Now what this did was to bring to the rural area a business and also to provide opportunities for the cream of the youth, who had always filtered out of the area because of the lack of opportunity, to remain in that area to acquire skills would be helpful to them throughout life and to stimulate by ten-fold the economy. These are some of the things that again enlightened management can and is doing.

Some other companies, for example, are bringing into the Indian reservations businesses to provide the opportunity for this group to avail themselves of the advantages of skills necessary to compete in today's economy. Another thing is the providing of support for needy students. Whether or not this is a government function is debatable, but certainly it is one of the things that the labor management advisory committee recommended and lastly, to provide for a general upgrading of our educational process. Well, so much for government's share in this problem.

I would like to visit with you about what unions are doing and it is in this particular area that I wish we had a Walter Reuther to visit with you. The unions have large programs in this area and these programs are

primarily to increase job security. A job secure to practitioners in the field of employer industrial relations for many years has meant the privileges guaranteed to employment by reason of length of service. But it isn't this kind of job security exclusively that the union programs are talking about. You have all heard of the shorter work week demand. This is the key plank in the platform of the American Federation of Labor. This is George Meany's principle, that in order to create jobs in this period of technological innovation, we must create more jobs by shortening the work week. Management, by and large, have opposed this on the basis that it is an impractical demand that they cannot afford economically. There are a lot of things that go into this argument. I could talk to you an hour about this alone, but the capital and equipment, the facilities required, the enhancement of moonlighting and that sort of thing are arguments that are tied in with the shorter work week plank in the union program.

Probably the most popular way of providing increased job opportunities and one that is supported by the administration currently is to increase the overtime premium. As you may know, companies that are in inter-state commerce are required to pay time and a half for hours worked in excess of eight in a day and forty in a week. It is proposed that this premium be increased to double time and the philosophy behind this is that by making the premium so expensive, rather than work employees overtime you will hire more employees to do the work. Managements do not work overtime because they like to; it is an expensive thing, but the cost of the major or fringe benefits that pertain to employment are very expensive. They are about 25% of payroll in the average manufacturing concern. They are so expensive that it is, in many cases, cheaper to work overtime than it is to hire new employees. It is interesting to note the administration, in its legislative proposal in this particular item, has come forward with a gimmick that is designed to eliminate or minimize moonlighting or dual job holding by providing that the second employer (if an employee has more than one job) has the obligation to pay the double time rate for all hours worked which, when combined with the first job, exceeds forty.

Part of the union's job security program is in the field of pensions which I think you have all read a great deal about. Here you have the problems of earlier retirement and the idea here is to permit individuals to get out of the work force without a loss or adjustment of pension benefits at an earlier date to create opportunities for those entering the work force. Another important part of this same general program is early vesting requirements and where you have movement of people between jobs it is quite a usual occurrence in an industry such as ours to provide for early vesting so that people can move from one employer to another and have vested pension benefits. The last round of bargaining in the automotive, aerospace industries, steel and major manufacturing industries, saw the vesting requirements generally reduced to full vesting at ten years without any requirement. Another element of the pension package that you read about and quite important is this "portability" feature. This is one that says you take your pension

credits and benefit amounts with you when you change from one employer to another. This is, at the present time, related to the same or restricted to the same industry or to the same trade or skill. The carpenters in New York recently won a portability clause in their collective bargaining agreements.

Increased vacations is another important part of this plank and here again you see that as seniority extends the amount of vacation is increased and it is becoming a pattern now to provide four weeks vacation after 20 years of service. Here again the trend is to create so much time off from work it becomes necessary to replace the individual. Several industries have extended vacations which amount to as much as 13 or 14 weeks of vacations covering a certain period of years for the senior part of the work force.

Sabbaticals are another thing, while not too important a facet in the union program, is one that is certainly in the technological areas, requiring more and more attention by management. Increased holidays are another way. The pattern today is for about nine or ten holidays, and if you cogitate on that a minute you can see two or more weeks vanish without performance. You can see what this can do to employment requirements.

Increased terminal benefits are becoming most important. Here, Walter Reuther has been the key person in meeting the problem of creating jobs through this device. It has been his theory that you spend money and you must have money to spend during periods of unemployment. His supplemental unemployment benefit plan in automotive and many of the other industries is one of the devices that is used to do this. Under this type of benefit, depending upon the credits that a person has accumulated, he receives generally up to 60% of his pay for a specified period of time. It started out covering 26 weeks and in most industries is now up to 52 weeks. So you can see that if you are in a position of receiving that benefit you have a very strong crutch to get yourself by on while you train or retrain for a new job. Another important thing that comes into this is the requirement that the employer or government assume the cost of moving people from one area to another in the event of plant dislocation or plant removal.

Now I have hurried over a lot of things that are just about as germane to the economics of doing business today as anything can be. These are the things your union representatives would want to visit with you about as part of the people process.

Now I have talked mostly about creating jobs, but that is not the sole and limited interest of the union organizations. Certainly they are out in the fore-front in creating job training programs. They have their own job training programs in many sophisticated unions. The electricians in

New York are a good example of that. There is a program to provide training programs within industry whereby the individual can either (1) acquire the skills that are necessary for him to do a job or (2) if he can't acquire them, he be given the opportunity to be placed through a seniority or other system in some job that he can do. You have read a lot about apprenticeship programs. This is one of the key planks in this type of program and this is a type of training program that is keyed to the young people. You are seeing more apprenticeship programs being developed in areas where you have never had them before. The electronic field is a good example. I expect you will see a continued emphasis upon this type of thing as a method of keeping people in the stream of employment in the period of technological process. One of the things that is not typical of government training programs, but certainly is one that I think is most important and one that enlightened union and enlightened managements are pursuing, is the development of promotional paths for individuals. This is a very simple thing. This is really communicating to the individuals those things that they must acquire by way of education and skills, in order to move to the next level of advancement within a particular field. Having communicated this information provides the opportunity either "in-house" or "out-of-house" ways for them to acquire these skills. This is what labor is doing in this area of getting people to acquire skills necessary to be placed in the jobs and the opportunities for jobs that I have talked about.

Managements role in this is not too much different. I do think there is one major difference and I hope that none of you forget it or fail to recognize it because it certainly is the MEAT of the coconut as far as management is concerned. It has to provide the job opportunity. It has to provide the money or produce or the service or the ability to provide the job and this is a very important thing. Without that, the whole thing stops before it starts. In connection with this responsibility, management has a very, very significant responsibility to take every step that is practical to lessen the impact of technological change. Many of you may realize that technological change is a very expensive change. You don't go out and order a computer like you would a refrigerator and expect to have it delivered within the week. It is an item that costs an awful lot of money and normally provides an adequate lead time for management to communicate to the employees and to the employee representatives about the change. I think management has a very great responsibility to communicate with employees to utilize this lead time so that there can be an adjustment in the work force if an adjustment is required. There can be opportunities to provide the individual with continuity of employment either within that company or somewhere else. I think another thing, is that it must cooperate with labor in getting the job done. Management cannot do it by themselves and a lot of managements would be incensed that I was standing here saying that to you. But unions are a very important part of the economic scene and they have a place in it under our system of doing business and enlightened managements must recognize the fact that unions do have a part to play and cooperate effectively with them in solving the problems that are involved in automated process. I think, too, that where possible and again this is a very large economic order, it should seek to provide these benefits that will sustain the individual through periods of retraining and unemployment.

I don't think there is anything wrong with creating a savings account for an employee based upon his service with you, if the use of that account can be restricted or limited to helping the individual through periods of unemployment or periods of economic depression. Another thing that is almost trite to say but it is focal of everything that we hear and do and breathe today and that is the fact that management must operate so there is no bias or discrimination based upon race, color or creed. I think that management is much maligned in this particular area and I would debate with anyone who cares to evaluate what managements have done in this particular area.

There are a lot of other things that management can do and should do. One of the things that is occurring as a result of this change in technology is the fact that you see a swing from the blue collar worker to the white collar worker. During World War II, for example in our company, the ratio of blue collar or skilled, semi-skilled employees to professional, scientific, technical employees was 12 to 1. By 1970 it will be no greater than 1 to 1 in our company. Now in the swing from the blue to the white collar in this technological change, management has a lot of things to do in preparing the individuals that comprise the work force, preparing the unions who represent the work force for these changes. It is a job of large magnitude, but it is one that I think is being and can be done.

I do think that unions have done a tremendous job and certainly have done a lot of good. I think there is truth in what you say. I do think that automation and technological innovations threaten unions in a sense, as the skills change as you move from the blue to the white collar worker. There has been an inability on the part of labor organizations to organize the white collar or the technical people, and as a result of that their memberships have decreased. More importantly their financial conditions have been lessened to a large extent as a result of that. Therefore their ability to operate effectively, I suppose, could be affected. I think unions are taking steps to organize the white collar people. I would not expect that they become effective as they learn how to organize and change their approach to the technical and scientific types. Right now the technical professional man is a pretty independent individual and normally needs to do for himself in mass producing industries. In large companies where you employ, as we do, thousands of engineers all this isn't so. I might point out that we have a union of professional engineers which I expect will be with us a long time.

I hope I haven't talked around your question. I think the answer is that unions are going to have to organize if they are to continue to be effective in this area. Even if they don't, I think enlightened managements will be aware of the problem and responsive to it.

Question: Will the teenagers (acceptable and usable to industry as they are coming out of school) or will they have to be trained?

P A N E L

MANAGEMENT AND LABOR RELATIONS IN AN AUTOMATED SOCIETY

by

J. Curtis Counts

Question: Mr. Counts, I feel that the influence of labor unions is being committed because of the threat of automation. Now in your presentation you gave us two points. One, that the rate of introduction of automation is crucial. And two, that industry must automate. Where do you think the controls of this rate will be maintained?

J.C. Counts: Let me say at the outset that I don't want to shock anybody too badly. I don't think that enlightened management has to have a labor union to get it to do that which is right, or to recognize the conditions that surround it. I don't want to have that construed by anyone as being an anti-union statement. I do think that unions have done a tremendous job and certainly have done a lot of good. I think there is truth in what you say. I do think that automation and technological innovations threaten unions in a sense, as the skills change as you move from the blue to the whitecollar worker. There has been an inability on the part of labor organizations to organize the white collar or the technical people, and as a result of that their memberships have decreased. More importantly their financial conditions have been lessened insofar as total amount of money is concerned. Therefore their ability to operate effectively, I suppose, could be affected. I think unions are taking steps to organize the white collar people. I would bet money that they become effective as they learn how to organize and change their approach to the technical and scientific types. Right now the technical professional man is a pretty independent individual and normally seeks to do for himself in mass producing industries. In large companies where you employ, as we do, thousands of engineers all this isn't so. I might point out that we have a union of professional engineers which I suspect will be with us a long time.

I hope I haven't talked around your question. I think the answer is that unions are going to have to organize if they are to continue to be effective in this area. Even if they don't, I think enlightened managements will be aware of the problem and responsive to it.

Question: Will the teenagers be acceptable and usable to industry as they are coming out of school or will they have to be trained?

J.C. Counts: I don't believe they will, in the sense that you ask the question. I hope you all heard the question. "Will these multitudes of teenagers that are entering the work force be equipped to go to work, or will they have to be trained?" In the sense of that question I believe they will have to be trained. What needs to be done, and frankly what is being done, is we are conveying to the educational institutions the basic requirements for employment and hopefully the curricula. The information will be kept current so that the individuals can come into the work force with a requirement of orientation only. But I think it would be too much to expect that this condition would have changed in the five year period that I mentioned as being a tremendously important one, as far as numbers of teenagers are concerned. We have to do a tremendous amount of work motivating people, particularly in the minority, or the depressed economic groups, to acquire the basic education that will equip them to get into training, and to accept training, so that they can go into industry. I am sure that you in your work all know the hopelessness that faces some of these people. It really isn't the teenagers that we have to educate to remain and get the basic requirements, it's the parents who are really forcing the individuals out of the schools. I think forced out is a better word than dropout, because I think it applies in a great many cases to the individuals, but I don't think they will be trained in the sense that you ask the question, No sir.

Question: I have heard some remarks from supervisors down at Convair in San Diego that most of these teenagers are very happy to get a pay check but they really don't want to work. Do you find any widespread evidence of this?

J.C. Counts: You can make that statement about anybody, I think. I can tell you this factually. We have gone into the rural areas, Tennessee is a good example, Arkansas is another, North Carolina is another. We have taken these kids right out of schools and right off the farms. They know how to work. They are willing to work, and they'll go right at it. I think that most, at least I'd like to think, that most of our teenagers are of that caliber. Now, there are some who, unfortunately, in my opinion, have the wrong attitude toward a fair day's work for a fair day's pay. A lot of people think the world owes them a living. I think it's been with us from time immemorial, but I certainly wouldn't categorize teenagers as being a lazy lot. I think they are just smarter than the dickens, and given the right instruction and motivation can make our country even greater than it is today.

Question: Do you feel that big business is paying the price of free enterprise, in that "haves" in big business have been asked to provide for the "have nots"? Is this resented by the big business executives?

J.C. Counts: There are two points to that question as I understand it. Is big business required to pay for the have nots? And do they resent it? One thing I would like to say at the outset is that I think another myth that needs to be exploded is that big business is in opposition to small business and is directly opposed to it per se. I don't think this is true at all. I do think that big business complements, supplements and supports small business. In an industry such as ours fully 50% of the business that we do is sub-contracted to small firms. Now this doesn't answer your question. I do think that big business is the leader and does pay the piper as a result of the pressures that are brought upon it, and certainly of its own volition, of developing some of these things that it feels are appropriate to doing business. Keep in mind that "it takes two to tango".

I do think big business does bring these benefits into being and that they do in some measure support the benefits down through small business. Whether or not they resent it, I don't know. I can't believe that the enlightened businessman feels that way. Though perhaps some do.

Question: As a local pastor of a suburban city, I would like to know more about the job statistics, present and future. How do I get this information so that I can be more helpful to young people planning for their future employment, or retraining for employment. Would industry be willing to release personnel from time to time to assist in counseling with groups of high school students regarding their future needs in terms of skills?

J.C. Counts: First, as to how you get the statistics. Number one, a very available source is the California employment service. Most of the major companies throughout the United States are cooperating fully with the state employment agencies in releasing this information and in communicating it to everyone. Let me give you an example. Yesterday, I had a call from a boat builder, a small boat building firm was about to embark upon a government proposal to build 50 small boats. In order to accomplish this he needed 25 certified skilled welders. He also needed 250 assemblers. His question was "Curt, should I bid on this, because if I do, and I get the business, can I get the people?" Well, this sounds almost ludicrous, but I had to tell him that there is a real shortage of welders. We can get the people for the assembler jobs trained, but the welders will be a real problem. We have been seeking welders in our own business for a long time and they just don't exist. Well now, this kind of a skill is not the toughest thing in the world to acquire. It is something that is going begging. I think it's because individuals with mechanical aptitudes don't know about it. Certainly we in industry would want to cooperate with you as a group.

Now as to the second part of the question. Yes, we certainly would, both as a company, and as an industry, be delighted to make available our representatives to counsel with them - to participate in youth conferences. We do this all the time. We have individuals that are well qualified to visit with and counsel with individuals

at all levels. We as a company would be delighted to do it, and I know that I could speak for our industry, as it is doing this all the time. If you have such an interest, if you would want to communicate with me, I'll be glad to do what I can to put you in touch with others in the industry in Southern California.

Question: The unions say there is an available supply of labor in California. If this is so why does Douglas advertise for help in eastern newspapers?

J.C. Counts: I think that the unions that are saying that just don't know what they are talking about. The labor statistics that I quoted indicate that there are one million males over the age of 20 in the unemployed group as of October '65. 600,000 of these are categorized as heads of families, which is another way of indicating these are the guys that have to work. Well, 600,000 or a million people is not a large labor pool for all of industry to draw upon, and the plain economic fact of the matter is that while we train lots of people (and we at the Douglas Company are currently training 2400 people) we need more than trainees to operate our business. We need people that can do the job now and there are not enough of these people. At least we cannot seem to get enough of them, and we have every benefit that is known to man and a good wage scale, yet, we can't get enough of them, so we're going out and seeking them. You all read (I call it a fiasco), that was reported in the press rather voluminously, about our efforts to bring 1500 workers, trained people, from New York into Los Angeles. The plain fact of the matter is we didn't bring 1500. We hired 223 of which I think 170 are here. We hope that the others will arrive some day. The one thing we did do, and we bless the news media for it, at our aircraft division which is Long Beach right here where we need these people, we had been averaging 1600 applicants per week and of these applicants we were averaging from 30 to 50 trained individuals. Since the news releases and the attendant publicity, we are averaging 1400 applicants per day! The quality has improved perceptibly and we are now hiring two or three hundred trained people per week and we hope it keeps up. We've just got to get the people to do the jobs and if they aren't here, we're willing to take them where we find them.

I'd love to talk with you about the problems that attend in the poverty areas and why industry doesn't do this and doesn't do that. Let me make a generalization. Industry is aware of the problem and is doing a pretty good job of helping in these particular areas and assimilating into its training programs, and into its employment, those individuals who have the remotest chance of qualifying.

Question: If machines now compete with the work of a high school education, what happens to persons replaced by machines who do not have the capacity to be retrained and compete? How can we be sure that benefits of automation will be shared equitably with all?

J.C. Counts: I don't think there is any answer to sharing the benefits of automation equitably with everyone at this particular time. There is a lot of truth in the question when it says, "what do you do with these people that can't be retrained," and the devastating fact really is that most of these people are your senior citizens - those that have moved along over a period of time in the same jobs and who have not been qualified or equipped. In many cases they are afraid to attempt retraining. I don't think there is an answer to taking care of them. I've told you some of the programs that have been developed, early retirement, terminal benefits and that sort of thing. That doesn't satisfy the person's ego or the person's need for employment and I just think factually it's the hardest thing to say that these people are in for a real rough go. If you can't equip them to do something, or put them in a spot where they can do something, they are going to get lost in this transition and it's going to be a real rugged thing. There are all sorts of suggestions that have been made; federal programs, that sort of thing, but the dignity of free employment is a real strong thing that needs to be preserved. But I don't have the answer to that.

Question: Your industry is greatly depended upon the government for contracts, is it not?

J.C. Counts: Here's another speech. I would have to say yes and no. Let me say this: the Douglas Aircraft Company right here in Long Beach has over one billion dollars of commercial business and we like to think that we are able to stand upon our two feet! Now there are lot of companies that are not in that position. North American Aviation, which is the largest employer in the business, is about 99% Government, and to that extent they depend upon the government for business. Let me tell you this it is a competitive business.

Question: How do power structures influence decisions made in some cases that are perhaps not the will of the American people for major developments? We know, for example, that 50% of the economy of Seattle, Washington depends upon the Boeing Aircraft Company and its sub-contractors who are working in this area with them. We know that at least $\frac{1}{4}$ of all of the economy of Southern California is depended upon the defense and space contracts.

J.C. Counts: I would like to think that the awarding of contracts by your department of defense is predicated upon the basis of selecting the best designed product, lowest cost, fulfilling the mission, regardless of the economic locale in which it is placed. There has been a great hew and cry about the economy of various locales. There has been a tremendous debate over the placement of so much government business in Southern California. I honestly believe that the contracts are placed based upon evaluation of the competition. Now, I do think that the impact upon locales are very important and this is one of the problems

that we must face. When all of the business goes out of Long Island, for example, and moves elsewhere. What happens to these people? This is one of the facts of life when you are in economic competition, be it government or non-government. If you don't make the sales, don't have the products, you don't have the business, you don't have the employees. I don't think we ought to help Boeing merely because it's in Seattle. I think we ought to help Boeing because it's got the best airplane and the best equipment. Some of these things work out regionally and I suppose some people would want to argue it. We just won the manned orbiting lab competition. That's Southern California. Lockheed just won the logistics transport. That's Marietta, Georgia. But I think Lockheed would have won that whether it was Marietta, Georgia or San Fernando Valley, California.

I don't know whether I have answered your question but I think if it's business, it has to be on the basis of product competition, not on the basis of economic factors. Lot of people disagree with that. You have to put the government money where the people are but in this world you better go where the money is, or the work is, if you want to eat regularly. That's my guess.

Question: Several question here are related to motivation and how we can motivate our young people. How can we motivate the unskilled so-called unemployables to want to be employed? People in Watts, for example.

J.C. Counts: I think the basic thing that has to be done is to create within them the knowledge that there is opportunity. You don't do that by going into these depressed areas and talking to people about them. There has been so much history beyond this, and there has been so much association with family and friends and examples of people who have tried and failed, that merely going in and pointing out what the opportunities are is not too effective. We have found that the most effective way we can do that is to take individuals who are highly successful in their occupation, or business or profession, and take them to these depressed areas, and use them to visit and counsel with the leadership in these communities. To visit with the youth, and particularly the parents of the youth. We have three or four individuals in our employe who are ourstandingly brilliant men in their respective fields. One of these, Spencer Robinson, is an aero dynamicist who has achieved many great things. We use him because he wants to be used in going into these areas and pointing out that this too can happen to you. Stimulating individuals to continue their schooling through part-time employment -- these are the things that can be done. But the most effective thing that has been done, in my opinion, is to utilize individuals who have come out of these areas to go back into them and say, "Look, it can be done. I'm a living example. I'm here to help you and here's what you need to do." There are lots of other ways, but I think that's one of the better ways.

I N T R O D U C T I O N

for

Dr. Simon Ramo

On June 8th I wrote our speaker describing the symposium and its purpose. On June 22nd I received a two page reply in which he (in part) said, "the program you have described is extremely interesting and worthwhile and I am anxious to accept". He then described what he felt would be a fitting closing to the symposium.

I am fully aware that many of you, by virtue of your somewhat restricting jobs, are not sufficiently aware of just who this man is. If you were in the scientific field his name would be like say---Paul Tillich is in the theological world. He has an international reputation. Next Sunday read the job opportunities section of the Times and see how many job titles you can comprehend at his company, TRW, Inc.

His Ph.D in electrical engineering and physics is from Cal Tech, Magna cum laude.

From 1954 to 1958 he was Scientific Director, U.S. Air Force Ballistic Missile program. This was when missiles were being conceived. Prior to that he was Vice President of Operations, Hughes Aircraft Company, and before that Director of the Physics Section of the Electronics Laboratory, General Electric. He was Executive Vice-President and Co-founder of the Ramo-Wooldrige Corporation.

As founder of this company he broke the barrier that moved the aircraft industry into the aerospace industry. In this respect he is a unique and farsighted pilgrim.

He has, or has had, memberships in the:
National Academy of Engineering
International Academy of Astronautics of the International
Astronautic Federation
American Association for Advancement of Science
Fellow, American Physical Society
Fellow, American Institute of Aerospace and Astronautics
Fellow, American Academy of Arts and Sciences

In 1964 he received two important awards: American Academy of Achievement Award (for exceptional accomplishment in engineering) and Air Force Association Award (for contribution to Air Force Ballistic Missile Programs) .

He has authored a number of books and papers.

His talk will close the speakers portion of this symposium and as such he will try to set before us his views. These ought to be valued very highly by you. The "Imbalance Between Accelerating Technological Advance and Lagging Social Advance".....and (what might be done about it).....the Vice Chairman of the Board of TRW, Inc., Dr. Simon Ramo.....

THE IMBALANCE BETWEEN ACCELERATING TECHNOLOGICAL ADVANCE
AND
LAGGING SOCIAL ADVANCE

by

Dr. Simon Ramo

I think that all of you will perhaps recall that near the close of his career, just before his death, Einstein made a statement that received considerable amount of attention. It just came back to my conscious memory as I was listening to the introduction because he said, "If I had it to do over again, I think the next time I would be a plumber." I was caused to remember that because I was saying to myself there must be a way that I can start and take care of what must be a clear need to all of these folks in the audience. After that introduction I need to remove an air of presumption that I am going to have as an incumbrance when I start.

Here I am a physical scientist, a technologist and surely the subject matter is not just that. It very much is not just that. It is concerned with the relationship between technology and our society and I cannot stand up before you and pose as an expert in the field of the humanities, the social sciences. This is your field and I remember that when Einstein issued that statement, I thought I understood what he meant. He was not thinking that plumbers do well financially. I think he was somewhat frustrated by the apparent difficulties of our world to advance socially, at least at a rate that to him would have been satisfying as a human. Being very sympathetic with the human problems of the world, and even more important, he realized that as an expert skilled in the mere physical science technological side, he had learned about such a tiny fraction of that which really determines what happens in life. He was disappointed that he couldn't have done more during his life on what he discerned to be the real problems. Now if Einstein felt that way, I submit to you that you should recognize that I know that the things that I will talk about today, I don't really pretend expertness.

I have some strong feelings about the fact that people out of the group to which I belong spend their time in advancing technology, and people out of the group that you belong to spend more time talking to one another. So I am going to be flexible and wherever there is a doubt as to whether I should come out with opinions on something, I'll do it knowing that you will take into account the fact that I realize that this is only one opinion. One that is a little different from what otherwise might have come to your attention and one that

will offer us material for additional discussion.

I think you should be congratulated in arranging this kind of a meeting to indicate that you are aware that we are headed for a very much more highly technological society than the one we are in. It should be obvious that it is a boon to mankind to learn the secrets of the physical world and to learn to put them to use for mankind. We in technology take care of the physical and material needs of man and in principle this should make possible tools to be used for a higher society, a happier, better adjusted society. But we also know that it isn't working exactly that way. If you want to say efficiently what it is that is true about technological advance, I think you have to put it in relationship to social advance. I think you can put it in terms of an imbalance or mismatch. In fact you might almost be able to make out the argument that says that the problem of this century is the imbalance between rapidly accelerating technological advance on the one hand, and lagging social advance on the other. There is a lot of evidence of this around. Perhaps the most conspicuous is the one we talk about a great deal. We ought to put it in this context. That is, we have learned enough about the release and control of tremendous amounts of energy so that in a split second we know technologically how to release enough to essentially destroy society. We have arrived at that kind of technological advance well before we have arrived at a social level that enables us to preclude this happening. We are on the verge of outer space conquest. We are about to move from being a limited, constrained two dimensional, this surface civilization on this little earth, to one of being able to explore and ultimately to inhabit, if we choose, the whole three dimensional universe. Did this threshold of capability come about because a mature civilization decided that this was worth doing? Because it could bring benefits to us? Or did it come about for some reason other than that. To over simplify a bit, (a little bit unfair but let's say it's 90% sound) we are at this position today in space because of a prestige race with another nation, because we have created a science olympics. We are about to have a semi-automated world. A world in which the physical needs of man, the material needs and all of the physical operations of production, transportation, accounting and so on, can be handled with a minimum of intervention by man. This suggests that we are about ready for a period ahead in which man's required effort to provide for man will arrive at a new desirable low point, releasing man for other pursuits than that of providing for his material needs. Yet we have a right to be terribly concerned as we arrive at this technological capability because we can see that the dislocations to our society, the unemployment, the confusion, the retraining, all of the patterns of society that will be changed by this kind of automaticity, are severe. What about our ability to take such possibilities, analyze them, agree on what should be done, organize to do them so as to exploit the scientific advance for our benefit so as to use these tools for the reaching of the goals of society? Here our social maturity is so poor that indeed about half of our time and energy will go in to seeing if we can't somehow legislate that there should not be technological advance. Even worse, to try to

pretend that it doesn't exist, hopeful that it might go away. To debate whether it is good or not, as though we had a choice!

As many of you know, we are on the verge of a revolution in biology. There is a wedding of biology and the physical and the mathematical sciences, so that biology, rather than being by comparison with physics a description of living matter, becomes one of understanding in detail and in depth. In the coming decades, we ought to be able to make major changes in longevity, in control of disease, even in influencing our heredity. To do that which is permissible by nature to improve man physically. These are amazing possibilities which may cause the biological science area to come forth by the year 2000 as a number one area of science in spectacular new discoveries.

At the same time this is happening we are properly worried about a population explosion in the world. We are concerned about the problem of how, where, in what way and to what extent we should try to bring birth control into existence. The problem there is not, to a first approximation, technical or scientific. It is a social problem and we are not prepared for it. In this area of social problem we can make out a good case by going no further than our smog problem, and our urban transportation problem. Now technologically there are a number of ways that any group of competent engineers would be able to outline to us how to move people and things about the greater Los Angeles area in such a way that it would give us improved flexibility, and individual choice. It would give us freedom from smog and greater safety. It would be cheaper, more economical, more reliable and it would handle greater traffic density. But none of these are really worth talking about seriously so long as we have no social machinery to bring any of them into existence! In the Los Angeles area, we cannot even consider some of the straight forward rapid transit solutions because we have no way of arriving at who should be in charge and how we will get there from here. We are that socially backward so the imbalance is very conspicuous right here on problems that should be of considerable concern to us.

Well, what does all of this lead up to? My remarks imply that technological advance is the biggest thing in influencing our lives in the future, or at any rate, the mismatch between social lag and scientific technological advance is. If it isn't the biggest influence of the century, it is that problem which will have the biggest influence on the biggest problem of the century. If you name something you like better as a big problem and ask why is it a big problem, (what's happening, how does it change, what do you have to understand) you will find technological advance versus social lag somewhere involved in it. What are the consequences if we are somewhere near right here? One consequence is that we succeed in blowing ourselves up. This is something that gets written about and discussed every day. (Oh, I guess it hasn't been showing up too much in the last year or so. We get tired of some of these things you know, but it is there nonetheless.)

We still have new and interesting problems that will come up to keep the idea alive. For example, the idea that we and the Soviet Union might not be embarked on a course that will cause us to create an H-bomb war. We always have the possibility that in a few more years more nations will have the capability. What's perhaps even more important and more frightening is that there will be more technological advances, unavoidable ones. Deductions that you make from what is known is a way of describing how you keep getting past the unknown into the known. These deductions tell us that we will know how to release even greater amounts of energy at even less cost so that it will be possible for even more nations to have a capability, until finally we are forced more and more to consider seriously the possibility that this is something that could happen to our society. Then we are suddenly back where we were before the test ban considerations gave us a certain amount of relief. The possibility remains that when we are backward socially and have the ability to destroy ourselves, we might indeed destroy ourselves.

There is another possibility. We don't destroy ourselves but we do adapt, in a peculiar way, to the technological society. We adapt by giving in. Since we cannot prepare ahead of time (since we don't have enough of our brain power going into analyzing the situation and deciding how and what and what our goals are and how to reach them) we have to solve each problem as it arises by crisis. We find ourselves with more and more of a controlled civilization. This goes hand in hand with the concept of additional automation of everything that happens in life. When I speak of automation here I really need a word that is superior to the word automation which is associated with perhaps replacing man's hands in the factory. I refer instead to the broader concept that our intellectual activities are handled more and more by machine; by electronics, by computers, by equipment and systems connected together so that everything that is to happen is based upon a storage of the facts. If you have a child, he'll be registered and there will be some automatic calculations of what society needs and where it needs it and his life will be laid out for him. We would see interconnected cable networks, machines, computers, signal communication satellites and people, all of whom are indistinguishable as cogs in this tremendous network of working parts. I would say that this is the robot civilization. That seems to be the other alternative that we move towards. Maybe we are half way in it now, I don't know. But, at any rate, there is another alternative. Neither of these look too inviting to those of us who haven't been properly re-conditioned.

Now the question arises, is there any other alternative? Are these two likely? I would like to concentrate on trying to present the case that there is another alternative. Without trying to find a name for it for the moment, let me suggest an alternative in which technology, strangely enough, has a special role to play. It is an alternative distinguished by the fact that we learn to use science and technology as tools for a society in which they are indeed our tools.

How can you even consider that third possibility of the truly super great society? We have to have some words now that are even beyond our present ones. How can you even talk about that when it would appear that almost by definition (certainly as a result of what we have already said up to this point) that the only way that we could do that would be to suddenly accelerate social advance. To catch up and in effect pass and get on top of technological advance. Since you say that is the problem, automatically you present a third possibility: just forget that the problem exists! There is a funny little angle here. It is perhaps based in part on the concept that things have to get worse before they get better, but more specifically it is based on the thought that here are some aspects of technological advance in the coming decades that will cause technology to be so powerful a tool for social advance, so powerful a lever, so powerful a force, that even as backward as we are, we may find that we are almost forced to use it to some extent almost subconsciously.

Let's go down through a list of that aspect of technological advance in the future and see if we can make out such a case. First of all, there is the effect of fear on the thinking people of the world. Centuries ago, no matter how powerful a weapon of destruction might be, so long as it really didn't ever threaten civilization, there was a ceiling on the amount of fear one might have of it. There was a ceiling, a limit, to the amount of pressure that that fear would create on all the thinking people to force them to get together and find a way to be certain that this destructive force was not used. I am suggesting that the advance in technology concerning the possibilities of the release of energy would it become so great that even a person only slightly trained to understand what it is about, begins to really see and believe that this could happen. Then in a larger and larger fraction of our thinking time during the day we will steal enough time to think about the fact that this could happen. As more and more nations enter the picture, instead of H-bombs you have I, J, K, L, M, bombs, each one more powerful, each one cheaper, until finally the full Einstein relationship $E=MC^2$ enables you to change matter into energy so easily, so cheaply that it becomes clear to all of us that one little guy somewhere that doesn't like the world might be able to blow it up. If it gets bad enough, it forces us to give time and attention to it. Perhaps more on the positive side with fear as a negative item, there are whole lists of things we could sight as examples. Some of them come under the heading of improved world communications. Now the speed of travel, the traveling by jets, the ability to get around the world in a matter of hours is not the limit. It's going to be possible to do it even faster. You can't insure a schedule in which you go from Europe to Asia, to the United States an hour or two apart, without having arrangements of tight inter-relationships amongst all of these countries. There is a great deal of investment in these kind of inter-relationships. There are people's jobs in it. There are spare parts, logistics and all aspects of keeping the communications and the schedule going. There are the plans of businesses as well as pleasure trips that are so involved in this kind of inter-relationship that the whole combination commits us to a tight small world. This is a factor that brings people together with

single objectives which is part of what we need in order to advance socially. Each of us can be on the freeway during peak hours and say, "They ought to pass a rule that says that during peak hours you stay off the freeway." When each of us feel that it is "they", when it isn't the most important thing on our list, then it is easy to stay away from facing up to the social problem and putting our brain power to work on it! But when you are committed to your jobs and your investment, perhaps your political career in a corporation which is made possible by speedy travel, then it begins to have an effect. Communication satellites are not just a new way to communicate around the earth. They are not just an engineering solution to the problem of the earth being in the way if we want to get direct communication between two points on the earth. The Communication satellites offer a solution that is economically very superior to previous approaches making possible a great deal more communication within a price that the economy can support. You can look for (in a relatively short time) the ability to communicate directly to your home, directly to your business from a satellite with the right kind of choice of electro magnetic frequencies and power and techniques of modulation and all of those words that describe the technical process, so that a nation interested in getting a message to another nation can do it directly to the rooftops of those people without having to go through a local network that is controlled by that nation. This means that not only do you make possible again a more tightly interconnected web of commercial operations, but you also make possible a fight for control of the frequency spectrum. One of the things that has worked reasonably well in international cooperation over the years, has been the recognition, (because it was a technical point you just couldn't fight against) that there was just so much room on the radio spectrum. You have to divide it up. You can't have everybody talking on the same frequency or no one gets through. And while in times of war and in commercial rivalry we can expect competition, areas of compromise are needed because it is in everyones interest to start working out some cooperative way of sharing the spectrum. Now, when you have technological advance to such an extent that it makes possible speedier, more efficient, broader, needed, useful communications (provided you do some cooperating) then there is a tendency toward cooperation that is very compelling.

We can go further in certain details to illustrate the point of technology being a powerful force in making possible social advance in the category of communications. We are learning how to translate automatically from one language to another. In our company (TRW) if you will forgive a reference to it, we have contracts in automatic language translation. We translate from Russian into English. We translate from Chinese into English and vice versa by use of the computer. Now, what is the reason for this? Well, again it has an economic purpose. It stems from the fact that a good deal of the translation process involves a type of intellectual activity which is mundane and which is in some respects beneath the brain. This is analogous to the idea of using a bulldozer to move a big pile of dirt. If you want to do a lot of translating very quickly a part of that

translating involves a lot of comparing of words and phrases. We do this with our brains and some of it can be done very, very rapidly. In other words, it can be done economically and quickly by a robot which simulates to some extent how the brain works but does other things beyond the brain. Gifted as we are and having as complicated a computer in our heads as we have, it is equivalent to about a billion transistors bigger than any computer that we have as yet envisaged, but nevertheless none of us could stand up and recite in alphabetical order all the people we have ever met in our life. To a computer that is very easy and if we have to add two plus two or similar figures, we might do about one a second if we are very sharp at it and after about five or six, I don't know about you, but I start making errors. It's boring. It doesn't go with my brain very well to do that kind of thing or to make comparisons of one list against another list to see whether they synchronize. A computer is easy to design. It does things of that kind at a millionth of a second. So there is a huge list of things that all of us do with our brains in handling numbers and facts and figures and comparing, that you can do better with a man-machine partnership in which the machine does the boring, the high rate, high capacity mundane part of the intellectual activity. Then the human brain is able to rise to a supervisory role, to a creative role, to an auditing and correcting role. I have looked at some of the Russian translation, for example, and it works about like this. You introduce into the computer by a special typewriter the letters as they appear off the sheet. That typewriter, in effect, changes each of the letters into a beep-beep that is recognized by the computer's electrical circuits. It sees this word - it has a vocabulary. Now, you and I know that just translating word for word will work for part of most sentences but it usually will give you a pretty horrible translation because of the complexity of grammar and because of the multiple meaning of most words and because of the strange way in which man communicates with man through words. But it is surprising how a certain fraction of time, you do get something pretty useful. The first step is that you have an expert in Russian and English who looks at this translation and he says, "Oh ho, here is a double meaning-the computer chose the wrong one". So we stop and say, "Well, now, wait a minute, this is going to happen again. You're an expert in English and Russian, now tell us when this word occurs what fraction of the time should it be meaning a number A and what fraction should it be meaning number B?" Well, this expert finds this is probably a question he never asked himself. It's a complicated thing that he may guess at most of the time correctly, but even he, when he translates, has made a wrong guess and he adjusts it after he sees it, to make sense and knows that it doesn't fit. The way to find out is to have the computer go through a huge number of cases and see what the statistics are. I can illustrate this with an oral analogy. Take the word, "too". When I say "too" you don't know whether I mean to, too or two and we're all experts on the English language. Just out of context, when you hear someone say Too, which is it most likely to be and what ratio? And if you just wanted the answer to that question you would say, "Well, I don't know." Take a newspaper or Shakespeare, take a look at a novel, a textbook or two and go through and see how often these things occur. Don't bother me with these statistics you've got

a computer for this kind of thing. Another thing you can do is have the computer print out the translation in triple spacing and underneath each one of these words put three different possible meanings and let the human being come through and work it out.

Another thing you can put in the memory of the computer (which is, after all, easy to extend just by more transistors connected on) is to make a note of the fact that the way you tell which meaning you want out of a number of meanings is to look at what happened before and after, and obey certain rules. In a similar way you set up a computer to play checkers and it beats any man at playing checkers if you give it a little time to learn. Every time it loses a game it looks back and it's never going to do that same thing again. The idea is to jump the other fellow's man and not get jumped itself. If you want to make a computer big enough it will consider a hundred moves ahead and if the world's champion can consider 101, set the computer up for 102 moves ahead.

I have dwelt on this one example because it is indicative of something that we are going to have to come back to in a moment and I wanted to take this one example and go through and say that it is possible to use electronics as a tool to extend the human intellect. To create mechanical, if you wish, machine brain power and to create a partnership that is smarter than the man alone would be in his ability to remember things, to compare things, to get access to facts I am preparing to say in a few moments that this, properly used, can have a tremendous impact on our society and on the way we use our brains to get social advance. I have suggested to you that automatic translation may make it possible for Russians and Americans and Chinese to talk with each other with greater ease without going through the burdensome job of learning each other's language. You want to understand what the other man is thinking. You want to learn from him what is on his mind, what he has to say. Suppose he could speak into his telephone in Russian, have the sounds picked up, analyzed electronically, put through a process and out of the other end comes out English. It adds up to be a tremendous factor in the use of our human brain power in communication with each other which is now impeded by the number of years you would have to take off and learn the other language. But what is even more important is that there is something even more significant, if not more spectacular in this in communication between peoples. I have suggested the extension of human brain power by electronic machine. By electronic networks that will affect every physical operation in the world, the control of those airplanes I spoke of, the practice of law, the keeping of the rules of our society so that the government can operate, the control of traffic on the ground and in the sky. Aid to the medical practitioner, aids to education and to engineering, the use of electronic networks to vastly extend memory and the ability to process facts to arrive at logical deductions, to compare, correlate and present information. This will, of course, mean that we are living with the computer. We are living with the electronic network as part of our intellectual informational activity that keeps the world going round. The electronic system becomes a partner.

I call this field (because I don't think computer is a broad enough word) intellectronics. Intellectronics means the extension of the human intellect by electronics. An intellectronics system becomes our partner in the running of the material-physical operation of the world. As a partner it has a vote and what it votes for is a language that does not have these rather silly and natural inconsistencies of double meanings. What it wants is a consistent logical language, with every sentence having one subject and one predicate, with every sentence having a subject in front of the predicate. Certainly no sentences of the kind I find myself with at the moment, with a place for the adjective and a place for the adverb. If you have more to say, if you want to qualify it more, if it is a complex thought, you force yourself to a series of short sentences because it is economical, makes the system work and it is easier to get translations. It so changes the whole system that it is worth doing. The computer wants, in other words, an informational discourse. It is not concerned with poetry and the beauty of the language, it is concerned with keeping the world's operation going and since most of us in our work are similarly concerned, the wedding of man with the intellectronic system will be partially on a basis of what is sound to the intellectronic system. What this does is force one language on the world, and informational language.

Human natural language may survive as a means of expression on the artistic plane. When you want to know at what time a plane will arrive, so you can be ready for it, you are not anxious to have this expressed with the most complex sentence possible. In a similar way, if you want to know, when you buy, whether you are buying it from a man who really owns it or not.

This leads naturally to another extension that has to do with getting the people of the world together in a common interest, made possible by technology. It commits us to a type of social cooperation, a commonality of interest, and a higher level of use of human brain power and this is the universal library problem. I have already made reference to the physician who may want to go to a file. Let's be a little more complete on that one. The year is 2000. We go see our physician and we find that the medical setup is quite different from the way it is today. I am talking about the differences brought about by advancing technology, by intellectronics. We describe our aches and pains and our symptoms and something about our history, but there is a lot more that we don't remember and wouldn't say if asked, because the questions might not be put very efficiently and because it all takes too much time. All we have to do is put our thumb in front of a little window that identifies us to the big setup in Kansas City that is connected by wire. This parades in front of us and to the eye of the physician on a TV-like scope a summary of our total situation. It displays what has happened to us in our lives in summary. If it looks like there is something about the heart that is acting up and he wants some details about what happened to your father and your father's father and what other treatments you had for that area, he pushes some buttons that magnify that area with more information.

Information that's in the file. He has a new kind of assistant, like an Xray technologist, and Xray technician, that might be supporting a radiologist. That person is sitting there overhearing what is being said and operates this machine to tie information back into the network. Back from this huge file comes a suggestion of treatment or criticism of the proposed treatment. What it does is provide statistics. The computer can just process the daylight out of all of the statistics with great ease so that if you are planning to try a particular thing this comes back and says to the physician, "Wait a minute, you have overlooked the fact that this fellow is also a candidate possibly for diabetes." You see the physician doesn't have to remember so much, or to put it in another way, he remembers a great deal more than his single brain is capable of because he had the aid of a tremendous memory system permitting him to bring forth a lot of inter-relationships that he might not have at his fingertips. He gets part of what he would get if he could have taken a much longer time with this patient and consulted a thousand other physicians who seem to have had similar situations by describing his situation and bringing forth what appears to be out of the file the most similar situations. He also has an obligation of putting what he did with this patient into the file.

There are new specialties in medicine that have to do with the study of statistics and the improvement of this whole procedure. There is a medical engineer who is concerned with the design of the system and who has both an engineering and a medical degree. There are others who give their whole lives to the processing of the data in effort to arrive at that kind of information. When the inquiry comes in it will be most helpful and this is a whole new dimension in medicine. It is a dimension that may be as important in surgery and we can see what it will do to the practice of medicine. The physician is not replaced, anymore than an Xray replaced a physician or a blood test or an electrocardiograph. But what happens is that his brain power is extended by his having, in effect, mechanical additional brain power.

This is but an example of a library problem which applies to every pursuit in which we are engaged that uses information, that uses our brains. We are talking about something in which there is tremendous advantage to the world for exchange of this knowledge. The fact that there is such advantage will be known to the users of the equipment, to the designers of it, and they can be expected to call out the fact that these things can be made available to us. They will be superior provided we form interrelationships. Just as this happens in connection with communication satellite programs and with jet travel and other aspects of communication, in a similar way it will occur on the intellectual front. Information storage and retrieval and utilization and processing will be used for all of our intellectual and informational pursuits.

There is a pressure to get an exchange of this information to create the cheaper central libraries and to let certain groups specialize in

enhancing the information and not have everyone have to duplicate it. The world will be that much further along. Everytime one of these advances happen in which cooperation would make a great difference then there is pressure for cooperation that would not otherwise have existed.

We can return to space to make a special point on this line. In space today a good deal of what we do is not involved in military, it is involved in pure research to find out what is true about the physical universe. It is involved in moving away from the limitations of this arbitrary little spot in the universe called the earth, shielded by the atmosphere and by the magnetic fields and receiving certain radiation affects. Now here clearly to the thinking people of the world it would be a lot better if we had cooperation to an extent that made possible the efficient allocation of resources for this purpose for world benefits. Of course, some international cooperation does take place between ourselves and the Soviet Union but not nearly as much as could be if we planned programs together. If we have social maturity in the world that would make this possible, we would go faster, it would take less of our resources to do it and we could do other things as well. The more we go out in space, the farther out we go, the more we explore a true new frontier, the higher the factor of absurdity of doing this in competition. Without prior planning to divide up what ought to be done, the higher that absurdity factor becomes and the dollars get high too. That is always a compelling force. The absurdity factor means you have to reach the thinking people of the world, and you have to reach them even though they are busy. They are busy with other things.

A conspicuous example that helps us make certain points is something that is described as eventual control of the weather. Prediction and control of weather involves tremendous advances in the science of meteorology. It involves advances in information handling because there is a tremendous amount of information you handle if you are going to try to control the weather. We have our particular characteristics here on earth and we get essentially all of our energy from the sun. If we could measure simultaneously all of the factors that have to do with weather, the densities and the temperatures and various sundry vapor contents and radiation effects, wind velocities, on the surface, in the water, up in the atmosphere, up in space, and bring all of these data to a central point where the computers are set up with prediction formulas, we could do something about putting matter and energy in just the right places. This kind of technological capability is not something you rule out, in fact you put it down as one of the trends that we are approaching today. When we do that, however, notice that it is all pretty silly unless there is a type of world cooperation, a type of social maturity to make it possible. Today if we try to do it even in the United States, we couldn't get it done. That is, if we knew technologically how to do all of this and try to fix it so that the weather in Kansas is a little warmer in the winter and a little cooler in summer, but at the expense, mind you, of the weather along the Pacific coast, who is going to decide what to do?

Put it on a geographical rivalry basis or a difference of opinion basis, difference of preference basis, put on a basis of different businesses, different pursuits. Should you cater to the football game or should you cater to the need for rain for the nearby farming area? I have oversimplified it but you see what I mean. If you want it on a broader international scale imagine that the Russians ten years from today call a conference and they say we have made advances with our big meteorological effort. There was just a rumor that they were carrying on but it wasn't clear to us until that meeting was called. They say we are prepared now to make the Sahara Desert arid and useful for the growing of food and the handling of a bigger population. We know just how to do it. We've tried it out in certain Russian land maps in great secrecy. We will put matter and energy in just the right places and this is going to have this affect here, temperature, humidity, etc. and oh, by the way, the only negative factor we can see is that in the United States the ocean will come into about the Rocky Mountains from each side. But every place else around the world it helps in everything that we can see! What do you, the nations of the world, think about this? Most of the nations of the world think it is a pretty good idea. They recognize a few problems, but all in all it looks as though it is worth giving serious attention to and we create what is known as the National Meteorological Agency and any or all meteorologists are on "Meet the Press" and on the cover of Time. They are giving speeches like this one about social advance and other things because they are now the most conspicuous fad of the moment. This is the great urgent national need. We must catch up with Russia in meteorology. They have passed us and how did they do it?

Now, putting aside the facetious little play here for a moment, this is an example of technology. It isn't here yet, but we're moving toward it. It can only happen with a type of world cooperation that we are not ready for today. But you can see that it could well be this would help the earth's civilization to advance in the direction that most people want. Then we must find ourselves sitting and meeting and discussing what to do about it. This is part of what is needed to make social advance come about.

I have saved education for nearly the end. Surely the way to get the most certain social advance is to improve our natural brain power. Maybe one reason why we lack socially is because we are just not smart enough to do any better. Hopefully very few of us consider that we are just as smart as we can get. We look at the next generation and it is certainly the goal of all of us to improve the training of the new human brains as they are produced. What I mean by training and education is the broadest possible definition that you could put behind them. I mean not just to know as much as possible, but to have clarity of thought, have originality, to have creativity, to have the right kinds of interests and stimulations and incentives. Now, all of these things that I have mentioned are terribly difficult things for us to write down, in a sense, and set forth as plans and goals. One reason why we don't do it well is because our time is largely

taken up with what I would call the mundane mechanistic side of the educational process. We are pretty sure that one point we want to teach them is algebra, perhaps, or teach 50% of them algebra, or 25% algebra, and surely we ought to have something beyond the blackboard and the book. The book was invented quite a long time ago and has made a great change in the ability to get large numbers of people educated. Again, intellectronics can go far beyond the embryo teaching machines that have been suggested. Consider this, for example: (Again, I make no claim that this is the way you do it, I simply want to indicate what technology can make available to us, and it can make available what I am going to describe. It can make available a thousand other directions in which to go we only need to rise to the challenge of using these tools). One of my boys, let's say, needs to learn trigonometry. We ask how can he do that most efficiently, most interestingly, so as to leave as much of his time and that of the human educator for the difficult aspects. But one thing he can do is spend a little time perhaps with other students, perhaps alone in front of a special kind of a console in which trigonometry is put forth to him in a nice three dimensional color set up. Of course, he identifies himself with his thumb print and they know what trigonometry he needs, they know where he stands. They know if he is my boy, of course he is extra bright (as your kids are too) and so they have already decided ahead of time because of his record that he gets the A course which goes faster. This A course is distinguished by the fact that you present a few facts and then ask a question, and it is a yes or no or ABC. He pushes the button and if he keeps getting them right it says he is smart so they speed it up, skip a few steps and in an hour he covers trigonometry, complete record and complete examination and the principles interestingly presented. If, on the other hand, he is one of my neighbor's kids, (a little bit on the dumb side) this will be quickly disclosed. He doesn't get them right or he doesn't get enough of them right according to our pre-set initial starting point and so it repeats and if he still doesn't get it, it shifts automatically to another way of looking at it and finally it rings a bell. There is something about this kid and trigonometry that don't go together.

Now, more broadly. You notice that I continue to refer to man-machine partnerships. Even in presentations if you limit yourself entirely to a set presentation, or you work entirely on extemporizing you don't get the best results. You have to have a pre-set extemporaneous bell ringing occasionally in any talk. Now, in education in the future it is possible to have, first of all, superior records and statistics. It is possible to have aids in presentation, aids in memorizing when a certain amount of that is needed. What is remarkable is that technology makes possible the analysis of the affect of particular approaches, a particular course, a particular presentation, a particular theory of what a person should get as a prerequisite, so that he will be able to do the next step well. This is possible with millions of students simultaneously because a system can handle such huge amounts with no problem. But on the other hand, you can synthesize for an individual student in a split second a custom program for him alone. When he puts forth his thumb print and

and his record, then he can be given a presentation out of a huge variety, far beyond anything we have today in books or presentations from a single teacher.

What is even more important is that we are talking about a partnership again. We are not talking about replacing a human educator. We're talking about elevating the whole educational system to where there are education engineers. These are people who specialize in the planning of what ought to happen and in the examination of what did happen. When the human educator looks at my boy or your boy in the session that they have that day, she looks at records that are presented to her quickly that cover a much bigger range, that are processed to relieve her of the kind of things she can't do well anyway, doesn't even presume to do. So just as the physician has the blood tests and the electroencephalography and so, the teacher will have before her indications of how this youngster appears to be doing in certain respects and she works on that part of it. Industry will be in the education act. Industry can rise to being the major occupation as well as preoccupation. It will get a larger majority of the resources.

Now, finally under the heading of what technology can do to enable us to advance socially? Some feel that all of this technological advance in a period of man's civilization when he is lagging in his social advance by comparison with the rapidity of the accelerating technological advance, must mean the coming of a robot society in which man's creative, imaginative, free thinking, his emotional, spiritual interests must move to a much lower position. I would call your attention to the fact that the same kind of technological aids that make possible a controlled society, presumably controlled by a government that is itself almost automatic, in which we as citizens have little voice, we are just an anonymous cogs in a big machine. The technology to make that possible also makes possible, however, an ability for citizens to know what is going on, and to register their choice, and to be interested, because they have a ready means for knowing what is going on and to communicate with each other. Again, a factious example, exaggerated and over simplified to make the point quickly. In each of our homes in the year 2000, we have a little box. It looks a little like a television set which tunes us in on the deliberations of those of our citizens to whom we have entrusted the responsibilities for putting together the issues, and trying to argue them out, and arriving at a decision. If we choose to do so, and a good deal of the time we will choose to, because we are so interested, we can vote immediately on the issue that is up. In other words, here is an issue: which way do you want it? A few seconds later you can ask for a push of the buttons, yes or no. You will know how the whole nation feels about it. The other possibility is that you find it a lot easier to use the basic concept of free enterprise, that is, risk independent capital. You put your ideas to the populous! You say, 'Now look, I have invented a franigaset or a ladell. I now go to my financial

backers not with the chaotic doubts that exist today that make so many companies anxious to have government support for their research and development because the relationship between return and risk tends to be so poor. It is easier to have individual initiative if you have better facts on the market. Now with your calculations you can make it for this price if you'll make a million of them. You can make it for a higher price if you make 100,000. You look at the cost of the factory and all of these things and now there is a relationship there that means for a relatively small cost you have reached the user. What is more important you have also reached the competition and someone says, "Well, gee, if that is a good idea, I've got a better one" and so everyone is encouraged by improved communications by the full use of technology.

I was using the invention only as a steppingstone to something more important. If you have thoughts of what should happen to create social advance, you have a greater ability to get those ideas before others. But what is important is for others to take part and to chew over. Remember that these others are the interested citizenry, they are citizens relieved from some of the tasks we have today that take up so much of our time because there is more of an automatic society. We have more time. Our brain power has been enhanced. We have more time to think about these social problems. We are the same people that we were hundreds of thousands of years ago, that is, given the opportunity we will be willing to engage in discussion to put our ideas forth, to differ with each other, to argue, to bring the facts out.

So I argue that technology, the same technology, that makes possible a robot regimented society actually makes possible (though it rarely gets discussed) it makes possible in principle, equally well, a society that has greater communication perceptiveness on the part of an interested citizenry. It therefore makes possible the full blossoming of all those characteristics of people in relationship to one another. Maybe that society of the future is neither the old century ago, rugged individualist type of capitalism, nor is it a government controlled economy that is under the heading of socialism. It may be a new form of free enterprise in which there is greater creativity, freedom, imagination and communication. The point is that technology makes this third possibility just as possible as does the others and in part it is for us to choose which direction we go by having in mind these possibilities.

If I were to attempt a two or three sentence summary, it is perhaps best done by converging into one aspect all of the examples I have given. Technology can enhance our brain power. It can make our time and our thinking available for social advance. If it does that then maybe social change, social maturity will catch up and technology will truly become as it should be, the tools for a mature society. With enough tools around, sharp enough, handy enough, easy enough to get hold of, we may use them to shape the better society of the future. That is my message for today.

P A N E L

THE IMBALANCE BETWEEN ACCELERATING TECHNOLOGICAL
ADVANCE AND LAGGING SOCIAL ADVANCE

by

Dr. Simon Ramo

Question: If we could press buttons on every issue that came up would we not then be involved in a "weather vane" type of government, where you would simply be expressing the feelings of the people at the particular time when the issue was before them?

Dr. Ramo: I have to say, 'of course'. We would have, through intra-electronics, a means for changing presidents perhaps faster than they did before De. Gaulle in France. But this is a way of describing what you would do if you were in the habit of making mistakes in the use of technology. You use technology to make possible communication between the citizenry and those to whom you give certain delegated but limited, responsibilities for controlling society. You choose the right amount of this so that perhaps, for example, recognizing the "weather vane" effect that you mentioned, the short term effect, you use it all as a limited advisory. They both take place only on a certain class of issue and only after there has been a substantial period of discussion. Other votes are taken on preliminary phases having nothing to do with the commitment.

I am merely inventing practical ways of using this kind of technological ability. There are obviously impractical ways, and nothing would be worse than to imagine what I would call an immature society's use of communications, which is as bad we know as an immature society's use of H-bombs. You might get the destruction in one case in a hurry and in another case you would arrive at it through what might appear to be common consent. We all know that we worry about the use of a centralized and controlled communication system for the spreading of a falsehood and propaganda and for controlling the minds of people. Both things are possible and the two that will make one possible will also make the other possible, and you have to imagine that this comes gradually. You have to imagine, too, that enough thinking people put forth the principles for its use in a timely fashion.

Question: In what way do you foresee the possibility of technology in the area of human evil?

Dr. Ramo: I think there are two classes of answers that come to mind immediately. One of them is again a purely mechanistic thing.

I must emphasize again that technology should be considered as a tool, never as a replacement, and whatever techniques we now have for influencing human evil, we can enhance those techniques beneficially if we use technology properly. Now, for example, if you can reach people to presumably improve their thinking, their goals, their adjustment to society by better communications, by better education, technology makes possible an advance there. Indirectly over a period of time that use of technology is presumably one approach and enhances the approach we now use. The other has to do with what you might call the 'protecting of the innocent'. The protecting of society as a whole from evil doing. This is associated with policing at the lowest level. The obtaining of evidence. The facts here can be made available on a broader basis more quickly, more efficiently. Police departments can have more information. What is perhaps even more important, is that law making bodies can have available to them, as the decades go by, improved knowledge as to whether or not a modification of the rules of society would or would not have a beneficial effect. They can argue, for example, that it is evil to commit fraud. Fraud sometimes goes unnoticed because we don't have good enough way to keep track of what is happening. If you have a superior system of keeping track you will prevent the fraud earlier. So there are a whole series of mechanistic aids to those who are concerned with what I would call either the policing or the legislating to control evil doing, just from the standpoint of maintaining protection of a society. There are both of these facets and in both cases technology can be used as a tool.

Question: Do you feel that through technology we may be able to find out the potentiality of a person and help that person to develop?

Dr. Ramo: I assume, although I am obviously not expert in that field, that today that kind of science which is concerned with this human attribute, or characteristic, is in an embryonic state. Now in general, all sciences, whether embryonic or mature, can be aided by improved tools of research. Again keeping track of the information, knowing what others have done and thought about it, is very important. Generally speaking today, in all aspects of science, we are bottlenecked by the inability to get the results of some scientific researchers into the hands of others. All of us who do one or another form of scientific research use libraries, but the problem of going through by hand and trying to figure out whether someone has done something that bears on your problem (of being sure that it reaches you) has become tremendous with the proliferation of the number of articles to be scanned. Sometimes it is almost cheaper and easier to do the research all over again than to find out if someone has already done it and get it out. This kind of a bottleneck will, I think, be attacked most sensibly in the rest of the century by intra-electronic systems. Again, I am saying, there is nothing (that I see) that is fundamental that technology brings forth to change our ability to pursue this kind of difficult science; this kind of difficult research in human behavior. But there is something that is so important that it is almost fundamental. A book, the invention of the printing press, didn't change man's ability to think.

It was essentially fundamental, because of the magnitude of the increase in communication of man's thoughts that it made possible. When we are so terribly bottlenecked in communicating our thoughts to one another today, and keeping track of all of the large number of perimeters that every embryonic science should be able to bring forth. I would warn you about this, however, and see if I can think of an analogy to make the point. Imagine that the time is hundreds of years ago and we're talking about a scientist who is trying to understand physical matter, a biologist that has no microscope. He can only do what he can see with his eye. We say to him, "Now look, we're going to help you. We have a brilliant invention and with this you can look at matter and you will be able to see it magnified by a hundred, a thousand, ten thousand times. Will this make a difference?" The biologist says, "Well, this is tremendous, this will make a great difference. I will solve all the problems of biology. I'll be able to see down into what goes on." And we give him this microscope, and guess what happens? He solves some of the problems in biology, but he sees a whole set of problems he never realized existed and his backlog of unknowns of unsolved problems is even greater! I suspect that as compared with missiles, or spacecraft, or computers with which I have spent my years, human behavior is so much more complex. The more you probe, the more you learn about it, The more you learn how to improve it, to control it, to influence it for the better by the use of additional tools, the more new puzzling facets you will find. This is the way of all properly conducted science. We are not going to solve the problems, we are simply going to arrive at a new plateau of sophistication in our exploration of them.

Question: This problem of 'instant consensus' bothers me. Particularly as I look at people in a counselling relationship. We see people come before us who have the intellectual capabilities to theoretically handle their problems. They also have the learning that permits them, with their capabilities, to resolve them, but still they come and react to their problems on emotional levels. How can we work with this on the instant consensus, that is, the emotional response to something or other?

Dr. Ramo: First, let me make clear that I use the 'instant consensus' example as an exaggerated, oversimplified example, not with the expectation that that specific thing would really be a sensible thing to do; but rather, as an example of the amazing tools that technology can make possible to us as we try to figure out how to use our brains to greater advantage to make for social advance. So I don't want to leave you with the impression that I am proposing instant democracy as the answer to communism, socialism, etc., as a new way of life. I am saying that it is possible for us to have a type of communication on the issues of the day amongst the people of the society at a level that we don't dream of today.

Now if you're not prepared for it, then, some of the things on our list of what you could do in the way of communications of ideas can be harmful rather than helpful. We know that. But it is important, when

you talk about great social advance, to see if there are means suited to our fast paced, highly populated, complex society, to disseminate the ideas of people; otherwise, it is easy to draw the conclusion that we go in one irrevocable direction. We don't express our ideas if we are controlled in our thinking. That is the only direction in which the thing can go. Now you have particularly emphasized one aspect of it. That is today, almost all of us in this room would, I would guess, say that the ability to vote immediately after hearing about an issue in the hands of a large fraction of people and you'll get chaos in the running of our operations. Still we go to the other extreme. We vote for president every four years. We vote for congressmen once every two years. There's quite a distance between our direct registering of approval, or at least preferred direction in those affairs that become more and more controlling in our lives, that stem from the national government. Furthermore, again, communications are not used to the fullest. When we choose a congressman, we make our votes felt every two or four years. We do this only as a choice between two possibilities. Sometimes perhaps three. Possibilities we may not have had very much direct influence on. Now there is much indirect influence. Over a period of time, I think, we all believe that a political party has to be influenced by the thinking of the people or it will fail. It will change to something else. All that is very long term.

For example: should we build a stadium or shouldn't we build a stadium. You'll find that if the public votes for it, you may find it's illegal from some other standpoint. You simply can't operate with that extreme where you don't account for all the inter-actions, to one where we express ourselves directly so rarely, and in so narrow a way. There could well be, even today superior ways of doing it. We're not ready for it in a number of respects. We can't even put in an urban transportation system. It's hard to imagine putting in any kind of a national network to increase communications amongst people today. Technologically it is quite conceivable. Socially we are far away from it. If something like this happens, it happens because gradually two things occur. Improved technology makes it easier and easier to do. Taking less money, involving less risk for those who do it. We become socially aware that we have the burning need to have discourse. We start demanding it. We get little pieces of it and then it grows. It doesn't come into being overnight. A city has some experiments in this regard. Perhaps small groups start broadening their town meeting approach.

Question: By what means may intra-electronics serve to control the panics of an immature society, short of a catastrophe, while still conveying a message of necessity of social change?

Dr. Ramo: I don't see any short-range impact. I think it's all a long-range benefit. The extending of human brain power should enable us to do a better job of educating. In other words, improving our natural brain power should enhance education. This is an

entirely long-range benefit, so that over a long term we should find our approach to problems less panicky, more deliberative. We wouldn't find ourselves with a big space program as a reaction to a Sputnik that took us by surprise. It would be because (out of the many areas of scientific benefit to man that were not being explored to the fullest and where technology was ready) we had argued out and chosen to give it priority. To put our chips there on some rational basis. Now to some extent this happens. It happens after the act. In the United States, we talk about these things, and our space program may be somewhere optimum today. It is several billion dollars a year. But that doesn't mean that we have the choice of putting that some place else. Some people suggest that it would be better to make seventeen Harvard Universities with that money or it would be better to cure cancer. But the rocket engineer who is left over from the inter-continental ballistic missile program (who can work on the space shot) isn't going to do much for cancer. So to some extent these things are separate and to some extent they are competitive. It's complicated and it's hard to decide where to put our chips in the use of our national resources when you consider everything. Perhaps we come closer to the best use of our funds if we allow a few years. We always seem to have a panicky reaction to whatever is the leading world issue of the time. We can hope, over a period of years it will get better. It may have to get worse first.

Question: If we cannot resolve some of these problems, will our first alternative, destruction, ultimately become inevitable? Is not some form of world government essential? Is not the Christian religion the important factor in developing an ultimate world concern?

Dr. Ramo: It is pretty difficult to imagine using technology to the fullest unless we are more advanced socially. There is no argument with that. It would be a lot easier to see it going the direction of either blowing ourselves up, or just plain losing "humanistic control" over the future of the society of the world. But, as I indicated, there are other factors. There are other aspects of technological advance that work in this direction. Now these questions could be answered optimistically by saying these things can be done right if we have more time to think them out. If we can rise above the use of our brain power for attending to the materialistic side of life, we may have the time. We certainly have the incentive for the thinking people of the world. But basically this is behind these questions. It's hard to see how you can do this without a mature society.

Now what are the characteristics of a mature society? I think I would put at the top of the list a society that uses its resources to the fullest in the pursuit of improved society. Everyone is going to have somewhat different ideas of an improved society. I personally am not too concerned about those differences. I think that the thinking people of the world are very close in their ideas. In other words, to rise to a higher level of social adjustment, we would find its effect snowballing. That is, if you can imagine what is equivalent of a world government (however you may say it) in which the government provides the tools and the people provide free expression and make their decisions as to what

they want done with the world's resources would be in the interest of all mankind. If you really get that, then the improvements that result would be orders of magnitude beyond anything you could have if you don't have that kind of cooperation. Then someone says, "But certainly this is going too far". Competition, for instance, is very important. If you eliminate competition between nations, if you don't have a science olympics, you will get less done, because this is inherent in man. He strives. Prestige is an inherent characteristic. Competition provides incentive. My rebuttal to that is (if this is true, and perhaps it is) there are numerous ways of arranging competition if your objective is to use the good part of competition.

I remember some years ago references made in the introduction to inter-continental ballistic missile program. During a part of that time the big program here in the United States was creating the inter-continental ballistic missiles, the Atlas, the Titan, the Minutemen. It was a critical race against time. The Russians were believed to be ahead. It was considered to be the most vital program the nation had ever mounted in the use of science and technology! It was greater than the A Bomb project. During that time there was a bit of inter-service rivalry at one point, which was very depressing. To observe the Army and the Air Force attacking each other and discrediting each other in the press. There is always a natural human result, if you arrange for competition in the wrong way. We were able to arrange in the program plenty of competitive ideas to vie with each other in other respects. There were several approaches used in most of the critical problems. There was competition for ideas. It is like constructive criticism as against destructive criticism. You can have criticism, but it does not have to be done in such a way as to insure that it be destructive.

So it is possible for someone to make an argument that says you don't need world government, so you don't need world cooperation. It is better not to have it. But, it seems to me, when they have 'lifted' their thinking every one of the things they seek to have, can be obtained by the greatest amount of basic cooperation, including cooperation on how to arrange for competition.

Question: What do you think is the essential role of a prophet in social change?

Dr. Ramo: Yes, I was going to say p-h-e-t or f-i-t. I trust you mean p-h-e-t. (Because you would be surprised how often the other one comes up.) Well, I think it is important that there be those who would choose to take the personal risk of trying to credit what will be. For one thing, most of us are not as imaginative as we would like to hope. We find it rather difficult to see what the possibilities are. We extrapolate directly from what is today. We assume the alternatives available to us are those of the past. It is common to suppose that we have a choice between the good old American "American System" of a hundred years ago. That we should return to some sort of state controlled

government, controlled economy, and all the negatives that this implies to the typical American. This is because, apparently, the people who site these two choices are unaware of the possibility of there being other directions that can give them the points that they seek. They lack the imagination, or they don't believe that these other possibilities make any sense or are worth talking about. This means either there have not been enough who have been interested in studying the matter, articulating it, or they haven't done it well enough.

Very rarely do we ask ourselves what it is we are really seeking here. One talks about individual initiative being preserved; the concept of competition, of risk, of having as much control as possible over your private life. You put down all of these things that are fundamental, and you may find that this requires then, a free market in which what you have to offer can be presented to those to whom you are offering it. This being done with the least inhibition and control. You can have that with technology, in principle, better than you have it today. We have the means for getting it from the idea of one man to the people whom he is trying to reach with his ideas. In the same way that the systems that makes this dissemination of ideas (and all the repercussions of that dissemination) possible, also makes possible a control of ideas, if it is improperly used. How do you get the proper use? How do you get the preferred use? Only by looking ahead and taking some risks. My own preference is to look far enough ahead. I like to toss the words like the year 2000, so that I can't be called upon in the near future to justify any predictions that I have made!

Question: This Theonetics Symposium has been a tremendous experience for me, and I am sure to many others. From where you stand what would you suggest as to what we do from here on?

Dr. Ramo: I think I would want to be very careful in tossing out advise, or suggestion, on that very key (you might say ultimate-concluding) type of question you have asked. For one thing, though, maybe it is belaboring only the obvious. I think you need to go on doing this. I think more groups such as yours should do it. I think the engineers, the physical scientists, those who are concerned with the technological side of life need to broaden their interest in the nontechnical side.

Along with this invitation I accepted an invitation to be the Chairman of Engineer's Week here in Los Angeles in 1966. It has the theme of the application of science and technology for the good of society. So instead of being a pow wow of engineering alone, it really goes to the heart of the problem. I happen to be a trustee of a few colleges. I have been making a nuisance of myself at Cal Tech and the state colleges by harping on the fact that it is all right for us to have scientists in our society who do a specialized thing, but there is a missing profession. The word engineering should cover it, but by practice it hasn't: this profession is the application of physical science and technology for the good of mankind. Now if you are going

to make that your life's work, to apply science and technology for the good of society, you would have to prepare yourself (as your minimum professional qualifications) to understand both science and technology on the one hand, and society on the other. It doesn't do for a technologist to get himself a bachelors, or a PH.D. in science, and say this is his life's work to apply science and technology for society; or to take a humanities course here and there with the idea that this is going to make him a better citizen, a better father, a better adjusted individual. He has got to take it (and more) as part of his qualifications. Now maybe this is a techno-sociologist or socio-technologist, but it may be the most important profession in view of the nature of the society that is developing. Now maybe we will evolve that kind of individual as part of the new makeup of society's thinking people. This may come about by people such as ourselves meeting together.

I think that if you find this symposium successful, you might try the supercolossal next year by trying to get a combined meeting of yourselves and, say, the Institute of Aeronautics Engineering or the American Physical Society. Then you have a go at it for five days in which you put together these issues of technology and society.

Question: Dr. Ramo, coming back to what you said in your address on education, I suppose I belong to the group that is in a mental lag. I just do not see how, when it is possible to relieve people from the necessity of getting old, that it would necessarily release them to something greater or better. Is it not essential that you have to take the primary steps before you can move out? It seems to me it is almost like saying to a child that through science we have invented a way by which you can really get around much quicker than learning to walk, so why take the primary steps, just get into a jet plane and get with it.

Dr. Ramo: I think there was at least one double possibility in my remarks about education. It's possible that I emphasized one differently from the way I intended and de-emphasized the other. To use your analogy of the child walking, I say if our present procedures in teaching a child to walk involved doing everything we could inadvertently to discourage his walking, and we were going to make the argument that he could walk a lot earlier; that he could walk with straighter legs, and could, as a result, be a happier child and advance toward his ultimate goals of getting his body developed fully within his capabilities, without trying to go beyond what should be the capabilities of a child, then we would have an analogy of what I am talking about. Now, when I went to school, for example, I spent many years learning certain disciplines, certain ways of thinking having to do with science and mathematics, learning certain facts that I have to be reasonably versitile in, in order to move rapidly into the next step without having to go back to a table each time. I would say that it is possible for me to imagine so radically changing that kind of education so that an eight year period could be put into two years enabling me, when I was thirteen or fourteen, to consider the theory of relativity instead of waiting until I was eighteen. Now the reason for this is the cumbersome-ness, the failure to use fully the tools that

could be made available, the shortage of high competence in teaching relative to the need, so that the amount of spreading of human endeavor was sufficiently thin.

I think the analogy that I made to the system before the book and after the book could be made again specifically in reply to your question. I'm sure it must have happened (although it might have been spread out over a hundred years) that something like the equivalent of this happened: The book is available and some are concerned that the use of the book, as distinct from person to person dissemination of thoughts and information, would constitute a comedown (an impairment) of education. You cannot replace human to human direct exchange with the book. I can imagine that there were some who would have had that concern. I think the thing you have to add is that you don't remove the good things, you remove the bad and you enhance the good. That should be your objective. Now, you can always do it wrong and you and I can imagine doing it wrong, and that of course is behind such a question. But if you do it right, they should be able to enhance this because there is no reason why you need to take a specific text book and have forty kids all learning algebra from that book by attending class a few hours a week and doing those specific problems when there are, shall we say, thousands of alternate presentations that could better fit the individual minds and state of the students. You can have the student's understanding control the speed at which he is receiving his information. Or he is being tested, or being stimulated, to think and leave more time for a higher level portion of this. This is if you do it right. Now, I can't invent all the things you could do with technology to enhance the process of education, but when you have these tools available, educators need to have the time to think out how to use them. It is a chicken and egg problem. Until they have the tools to help them, they don't have the time to figure out how to use the tools. However, gradually as they get the tools they get more time. Then the things that we want to do ought to be easier to do, and it ought to make the educational process that much superior.

Question: You seem to be very optimistic about technology and what it ultimately will bring to man in the final analysis. Do you think that technology will play a major part in bringing man to his knees, or you might be interested in the other direction, but man finding his reason for being?

Dr. Ramo: I am aware of the fact that I have been optimistic and I think there is a basic reason for this. I mentioned a couple of negative alternatives. I don't want to imagine that we either blow ourselves up or that we become robots, so I look for evidence that there are other paths. But there must be something basic behind it.

It started out with the conviction that you don't prove from physical science, and you will never prove from physical science or technology, that we are here for a purpose. To have intelligent man reduced to the

equivalent of a gear or a transistor and have this become the way of life on the earth appears to be to be in violation of that conviction that I have. So my optimism must stem from my conviction. I suppose in that sense none of this makes any sense unless you assume that what you mean by use of increased brain power, the use of science technology to the fullest, man's intellect being available for greater attention to his social problems, is that we'll do a better job than we now can do in defining our goals, perhaps coming to what we consider to be an understanding of what we are here for.

I don't expect that we'll solve the problem in the sense of having irrefutable proof that it satisfies everyone that there is one answer as to why we are here. I think what we will have is a more efficient system for debating it at that time.

THEOPROBE FOR SYMPOSIUM III

by

The Reverend Clifton Weihe, Director
The San Fernando Valley Project of the Luthern Church of America

I want to say that this conference has been an eye opener. I don't know of any denomination that has attempted anything like this.

Now the danger is that we will not take seriously enough what these men have been trying their very best to say to us about the modern world, with its increasing speed of advance in technology, mass society and mobility. Now our experts look to us churchmen for leadership in social advance.

I was reading John Robinson a few weeks ago and he said in Luther's day man was asking the question, "How can I find a gracious God?" and today men are asking the question, "How can I find a gracious neighbor?" He says this is the question that is in the three Synoptic Gospels and this is where Jesus addresses himself as being the gracious neighbor, where St. Paul's instructions in the Epistles are to the behavior of the Christians and of the congregations.

I am going to react with perhaps some questions and perhaps some comments on certain keys that have been touched in me. I am certain that while these keys had me playing a tune, the speakers were saying some things that touched you and which perhaps I didn't even hear. I started out last night mulling over yesterday's speeches by putting these in the categories of creation, redemption, sin and grace and so forth, but this morning I erased all that as I think these things are obvious.

I would like to start off by just mentioning very quickly impressions that came to me: one impression was the seriousness of the speakers and the colleagues with which they work about the job they are doing. A year or two ago, Dr. Helmut Thielicke was speaking at Thousand Oaks and I met a young chap who was working with the computer system in developing language translation. He said, "Well, I have to go home. I have a meeting at midnight". "You have a meeting at midnight, Ted?" "Well", he said, "it's the only time that we fellows can get together, the rest of the time we are busy so that we have a meeting from 12 to 3:00 a.m. for the people in my field so that we can study and share each other's findings." This is how seriously these men are taking their work!

How seriously are we who are pastors taking our work? How seriously are our congregations taking our work as we preach as never before to a world of dying men?

Secondly, I hear prophetic voices among these men who spoke to us. I was particularly impressed with our friend, Norman Peterson, as he stretched our minds ahead not 25 but 100 or more years. I think from all of our speakers we have had a prophetic strain, and in some cases a major emphasis which makes us grapple with the present and even more-so with the future. Their willingness to communicate with us impressed me and they look to us, a number of them said, for leadership in the sphere of morality and in the sphere of social concern. They don't have the answers. The machines don't have the answers. They are searching for truth and have sensitivity to humanity and to social concern and the use of the computer to utilize or realize creation, to extend the mind and the hand of man so that it is more useful. This is certainly increasing the creativity which God has built into the world and into mankind. And one of the big notes, the bass pedal that was always on here, was the inter-disciplinary cooperation that is needed to accomplish the things that are, as our speaker said this morning, being pushed upon us by competition with other countries. Here we are, as Christians, failing not only to cooperate with each other, but failing to use the inter-disciplinary tools and resources that are available to us among our own members and among the world's men of goodwill.

Looking ahead to the future and trying to plan what is coming up, I think this prophetic note took care of that and then I asked myself the question, "What can we apply to the mission of the church from the techniques, from the systems technique, for instance, struck me very strong at Theonetics I, and then Mr. Peterson's concept later on of stretching this out into the future struck me. I'm going to come back to that in a couple of minutes.

Then, of course, the question came up this morning, "what are the next steps"? I like Mr. Ramo's suggestion that we start a dialogue with other groups. Of course, you know that this has been going on in Europe. I have been fortunate enough to have had study trips in Europe with the work of the church in the summers of 1961 and 62 and saw the work of the academy and the social work in the cities and with the farmers. The dialogue between the theologians and the factory managers, the factory workers, the apprentices, housewives, the politicians, etc. We are just beginning to see the importance of this in our country. So we look ahead to meeting with other specific groups to dialogue and to understand each other and to see how we can contribute to the whole. We see the world more and more as one world, I think. The world is shrinking very, very rapidly.

Importance of research in the church struck me as something we have been working with. Mr. Bellman's story of Gertrude Stein's reply, "What is the question", I think strikes us very hard. We are often seeking the answers to questions that may no longer be relevant. We have to, in searching for the truth, ask the right questions and not think that they are all in the form of answers, and that we can presume to know, that we do know the right questions. We cannot find these right questions with-

out dialogue among ourselves with the world of affairs, with people of other denominations and even of other faiths.

I am tremendously strengthened by the work I do with the Inter-Faith Commission in the San Fernando Valley where we have Roman Catholic lay people and occasionally a priest (even in the Los Angeles diocese) and the Jewish people who come and the people from several protestant denominations. There is enrichment there and these people come from a religious base. As a matter of fact, and this is parenthetical, due to a happy series of coincidences we are catalyzing a series on Pierre de Chardin and his book "Phenomenon of Man" at the Valley State College in February, a series of three nights put on by five Methodist laymen from St. John's in the Valley, Canoga Park. It will be an inter-faith venture sponsored secularly by groups at the college, such as the Sociology Club, and we hope the Anthropology and Philosophical Club (these men include a nuclear physicist, a nuclear engineer, the top artist for one of the big advertising firms on the west coast and two men who are in publicity and art). This is evidence of trying to attract the scientific community.

In finding the right questions, there has to be inter-disciplinary cooperation with the people who know what is going on in the world. Here again is this two-way communication. It takes the man in the world, in the various fields of vocation, to tell the theologian what is going on out there, and it takes dialogue with the theologian to acquaint the man toward discovering what's the meaning of it.

I see here the necessity (I think you do too) of high level training center for the laity, to include all Christians. A laboratory for mission of the church; bring the church together so it can go out and meet human needs. This forms Christian mission, the servanthood of the church. Here we will need all the talents and all of the gifts of the spirit which do not yet operate. This, I would think, could be called the 'systems' approach to missions and it cannot be done by a fragmented body of Christ. It can be done by a unity of the spirit and of the person. It is almost as hard in the San Fernando Valley to get ecumenical cooperation as it is to get the Lutherans to work together. In this training center we would deal with factual material. We would bring in people from various disciplines who know what the world is and can describe it to us in terms we understand, and from a viewpoint that we can see it in a new perspective, teaching us to be sensitive to the new possibilities brought up by our speakers. We would have our small groups shaped around people from local communities who in turn would go back to their local communities and begin some kind of a witness that would be meaningful, and which would carry something of the reason for the existence of the church. We need efficient and effective employment of all people who do not find a place in the present structural organization of the congregation. We are all too likely to take the 5% or 10% that are very active in the church and say 'they're the real good Christians'. I recall a little story in Matthew 25 which talks about the sheep and the goats and how surprised some of these people were when the Lord said, "Come, inherit the kingdom."

The others were chagrined because they thought they had been pretty good servants of the king. It occurred to me that there were two points I had never noticed in the story before. One was it speaks of the "son of man". "When the son of man comes to the glory to be seated on the throne". "The son of man", it doesn't talk of the son of God and it also talks about the nations. It doesn't talk about people. It doesn't talk about church members or Christians. It talks about when the nations come and the nations are to be separated which tells us something about corporate responsibility. I believe that this has been a strain through all of this symposium. I have a note here, "down with parochialism!" We have all kinds of catch phrases on this, stained glass fox holes, stained glass ghettos. I like Hans Margold, who was with the World Council Evangelism work, and his 'common goal' concept of the church. Come fit into our system no matter how it cramps you, come and fit into it but if your legs stretch out over the edge of the bed, we'll do like the old Greek fable and cut your legs off. If you're not long enough, we'll stretch you, but you have to fit our system like grandpa established it back in the 1880's. Hans goes on to say we've got to be a 'go' church. It reminds us that in one of the ancient Roman Catholic masses, the benediction started with "ite" (go now and do your ministry). Here is the launching pad. Your worship before the throne of God. You fellowship with God's people; now go! But then there has been the missing link. Here again technology comes into the picture and shows how thoroughly people are trained. It isn't going to happen automatically.

Obedience and success, I have written down here. Naturally, the scientist is looking for success and here I think we divert from the scientific community. We have prophet instead of profit; that's the difference. We cannot say we're going to be sure of success before we start anything. Of course, a scientist isn't either, but once he has made an experiment and he is usually underwritten by the government and I think the analogy is not bad. God underwrites us too when we make mistakes and start unsuccessful "experiments". The important thing is obedience. Obedience equals success in the mission of the church. We have to take risks and be willing to be fools for Christ. Business doesn't want to do this. They want to be paid for their advanced risks. We have to deal with the false fears of people. Now, how do we do this? I don't have the answers on that, but it is a good question. Deal with the real and false fears of people regarding the new, and to make the new things, the strange things that people are afraid of, happen instead of remaining liabilities. Because they are there we are going to climb new Mount Everests. The church has always dealt with vacuums of life. Where society didn't carry education through the so-called Dark Ages, the church did through its monasteries, etc. Where there was a need for medicine and hospitals, the church developed them. The church was the cradle and mother of the modern nursing profession. Florence Nightingale was trained by deaconesses on the continent and thus began the nursing profession. They came to this country and started colleges. I personally raise the question as to whether we're not practicing false stewardship in these so-called church related colleges which are horribly expensive. Our seminaries are moving to the university centers and we insist on starting new church related colleges and thus insulate our young people from the world during their Christian college experience so they get, like I did, as naive as they come.

Now what are the vacuums that the church has to fill today. I think they were mentioned and I shall not repeat them. I think there were some good examples that were given. We have to see what is outdated in the church and get rid of it, not because it is bad, but because it isn't good enough. The Mercury spacecraft flew four times. It was outdated, it was obsolete in a very short time. There are things in our church that are obsolete and have to get out of the way. They become relics even as good as they are. We have to seek the best. We have to tread the furrows, the little furrows for one pearl of great price in each age and these ages are getting shorter and shorter. The evangelism of 1955 is passe. We have to think of 1966 now. The speakers have shown us the need of respect for the person as an individual. Here again we have a very strong truth which comes to us from the Scripture. There is the need to help people adjust. I would like to call attention to one thing that probably was not mentioned. That was the woman, the wife. The man and woman marry and they are on equal terms educationally, culturally and so forth. But the husband goes to night school, he moves in a sophisticated circle in our technological society. The woman, if she remains at home, gets lost and is back here somewhere, unless she too improves herself by going to night school or pursuing a hobby. She is going to feel like a misfit with her husband when he is in his circle because she has not kept up. If we are talking about the place of woman as someone, here is certainly one place where the church can be of help in just reminding people of this and possibly helping them.

The 'generalist' (which came up in our first symposium) is a symbol of the need to educate the whole person in our congregations and in our communities. Then there is the importance of 'task forces'. There is a story that I heard about a company that had let bids out for waste disposal system for astronauts. One bid was for a million dollars. This involved freezing the human waste, making ice cubes and tossing them out into space. There were all kinds of intermediate systems. There came a day when they were going to put two astronauts in a tight, small space to live for four or five days and they had to have a waste disposal system. Finally, a group of men were sent into a laboratory (with food and coffee) and locked in there until they came out with a usable idea. They spent about 57¢ and came out with a system that has been used since in all the manned flights. It is a plastic container with a blue pill in it which they massage to keep it from blowing up from the waste gasses, and then they put it in a little garbage place and dispose of it when the astronauts come back to earth.. It didn't cost a million dollars. This has something to say about what a task force can do in a hurry when they have to do something. That's one of the big stresses in the churches that are going places today. The small discussion group. The army has found that seven people are the ideal group to get something done quickly. Bob Williams, at Canoga Park, has fourteen groups going. One group meets for discussion every Friday morning at 6:00 o'clock for breakfast. This congregation has some real muscle and steel in their backbone because the units of this body of Christ are strong with inter-personal relationships that have been built up.

CLOSING REMARKS OF THEONETICS SYMPOSIUM

by

Edward B. Lindaman

In the opening of this symposium we talked about "seeing" that goes beyond itself. About changing the original chaos into creation by naming it. About "seeing" that means more than just visualizing the creation of a physical world. About "seeing" IN and THROUGH new discoveries---all of the implications for mankind. About development of man's potentials; of human fulfillment; of seeing HOW these things, events and people are playing a role in history and in lives.

This symposium is now over. Our biggest question now is: Have we really listened? Have we really seen? How do we become aware (NOW) of God's intended action for OUR situation---our lives---our world---our community? How? Perhaps....(and of this no man can ever be positive--for no man can manipulate God)...but perhaps it is God when there bursts forth into our minds a CREATIVE IMPULSE to do, or to be---an idea, a thought, a new approach, a new concept, a new horizon glimpsed for the first time. A new solution, some TRULY ORIGINAL THINKING....which may not even be remotely related to anything before but that has, by an unmistakable savor, an undefinable feeling of something significant. Then, as we PURSUE IT, (instead of letting it go by, as we've done in the past) a miracle takes place, for it changes our attitude, our whole outlook. In the very pursuit of it, it TRANSFORMS US! MAYBE THIS IS HOW RENEWAL COMES....each listening for HIS new beginning, HIS willingness to be open to a new leading...THEN to respond to it. (As Paul Tournier reminds us in his book "Adventure for Living", it is never the problems that change. It will always be WE ourselves that change.)

What was once a frustrating, moth eaten, great unmet, unsolved problem (because WE have allowed ourselves to change)---NOW becomes our purpose, our pursuit, our hope, our excitement. That which bears us up FOR A REASON---that it is part of God's intended creation--not a part from it. Isn't this God's TRUTH breaking in on us? (And here I use the word truth completely, totally, and utterly interchangeably with Christ). We don't do this. Something comes upon us from outside ourselves. It is sensing God's truth breaking in on us ENABLING us to take on an active part of His still expanding creation---whether it be in the laboratory or the sanctuary, the operating room or the city street. "Enabling us" where we are (as individuals) and where we are together.

We are obviously living on the knife edge of NOW. Faith is the discovery of the surpassing significance of now. Decision is dealing in

futures NOW. And any man who desires not to respond to the TRUTH (in whatever way that truth may come to him) desires to be (and will be) less than human.

These past days of the symposium...have you seen? Have you heard? Will the excitement of renewal begin for you....because THIS TIME (if never before but this time) you will pursue that vision that the living God is even now placing before you -- and not let it go -- and in this pursuit let yourself be miraculously transformed..... in a way you never dreamed possible. Paul puts it...Romans 8..... "In my opinion, whatever we may have to go through now is less than nothing compared with the magnificent future God has planned for us.

The whole creation is a tiptoe to see the wonderful sight of the sons of God coming into their own.

The world of creation cannot as yet see Reality, not because it chooses to be blind, but because in God's purpose it has been so limited, yet it has been given hope.

And the hope is that in the end the whole of created life will be rescued FROM THE TYRANNY OF CHANGE and decay...and have its share in that MAGNIFICENT LIBERTY which can only belong to the children of God!"

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