Teledyne Report

For the Year 1987

New Unmanned Airplanes: Advanced Developments Expand Capabilities.

Unmanned Airplanes: A Glossary of Terms

Drone: An air vehicle that flies under the control of a remote command center which may be on the ground, aboard a ship or in another aircraft.

GPS: An acronym for Global Positioning System. This U.S. system, as yet incomplete, will use 18 satellites to provide precise positioning data to receivers located anywhere on earth. Accuracy to within 20 meters will be possible for commercial use, with higher accuracy available to military users. Seven satellites are now in orbit, providing partial coverage. The system will be used to update the position accuracy of navigation systems, such as those used on the new Teledyne Ryan UAVs.

Knot: A unit of speed that means nautical miles per hour. Universally used in air and sea navigation. (See nautical mile.)

Mach number: A number used to describe an aircraft's speed in relation to the speed of sound. Mach 1 means the vehicle is traveling at the speed of sound. Mach 2 is twice the speed of sound. Values below 1 are called subsonic speeds, and above 1 they are called supersonic. However, because the speed of sound varies with altitude and temperature (both of which affect air density), a direct translation to miles per hour can only be made if altitude and temperature are given. The speed of sound at sea level, at 70 degrees F is approximately 760 statute miles per hour, or 660 knots.

Nautical mile: A distance of 6076 feet, in contrast to the statute mile used in land travel which is 5280 feet. Nautical miles and knots are used in navigation because the nautical mile bears a close relationship to one minute of arc, or 1/60th of a degree of latitude, measured on the earth's surface. Using these units greatly simplifies navigational calculations.

Payload: The cargo, vital to a specific mission, that is carried by a vehicle. A missile's payload is its explosive warhead. A UAV's payload is usually electronic and optical equipment needed for gathering, storing or relaying reconnaissance information, or similar purposes.

Reconnaissance: A survey or examination of a selected area to gain new information. The mission may be of either long or short duration.

RPV: An acronym for Remotely Piloted Vehicle. An unmanned aircraft that is controlled by a pilot from some remote location. (See UAV.)

Sensor package: An assemblage of electronic and/or optical equipment used to gather data. It can involve photographic or video cameras, infrared or radar sensors, or electronic receivers for monitoring radio and radar signals.

Surveillance: Monitoring or keeping a close watch over a given area or a given object. Implies continuous, frequently round-the-clock, observation.

Target: A vehicle, such as a drone aircraft, designed to simulate a particular type of hostile vehicle, such as a fighter aircraft. Used to train air and ground crews in meeting such threats.

UAV: An acronym for Unmanned Air Vehicle. The name can designate both RPVs which must be flown by a remote pilot, and unmanned aircraft that can navigate themselves and carry out complex missions autonomously.

UVS: Unmanned Vehicle System. Another name for a UAV.

UNMANNED AIRPLANES

They started as target drones, controlled by radio commands from a human operator. Now, with powerful onboard computers, precise inertial navigation systems and accurate position updates from satellites, they can operate autonomously for long periods at great distances from their bases, carrying out complex missions that are too dangerous, expensive or tedious for manned aircraft. Teledyne Ryan Aeronautical has just introduced two new advanced robot aircraft of this type.

Robot aircraft. They have been called target drones, radio controlled aircraft, remotely piloted vehicles (RPVs), special purpose aircraft (SPAs), unmanned vehicle systems (UVSs) and unmanned air vehicles (UAVs). Whatever their names, the goal has been the same: to remove the human pilot from the cockpit. The primary benefit has been to eliminate the risk of human life on hazardous missions. But as soon as the pilot is removed many other benefits accrue. Support systems to accommodate and protect him are no longer needed. Seats, instruments, manual controls, oxygen and pressurization systems, armor, ejection equipment and other man-oriented devices can all be eliminated. This in turn permits smaller, lighter airframes, smaller more fuel efficient engines and great increases in range, endurance or carrying capacity, at much lower cost.

Drone aircraft were first widely used as target vehicles for training combat pilots and air defense personnel. The Ryan Firebee I is one of the grandfathers of them all and is still in production today, almost 40 years after its development. (See Sidebar: A History of RPVs.) Later during the Vietnam conflict, many Teledyne Ryan Firebee target vehicles were converted or redesigned to carry out unarmed reconnaissance and electronic countermeasure missions over hostile territory. (Teledyne Report for the year 1980: Those Ingenious Flying Machines).

On the Cover:
Teledyne Ryan Aeronautical introduces two new unmanned aircraft, the Model 324 and the Model 410.

From RPVs to Unmanned Air Vehicles

The term RPV, or remotely piloted vehicle, implies that there is always a man at some remote location who actually controls and flies the vehicle. The limitations of this are obvious. The man must either be able to see the vehicle he is controlling, or be informed of its condition, position and environment by some form of remote electronic communications link. The latter option opens the possibility of losing control through interference or jamming, and either option can limit the range of the vehicle.

This has led to the use of the term 'unmanned air vehicle' or UAV to designate a vehicle that can be programmed to navigate and fly itself on complex missions far beyond the control of its base. These vehicles can store a variety of mission programs in their on-board computer systems, and can be reprogrammed in flight or 'flown' by their ground controllers when they are within control range.

A New Generation of UAVs

The earliest unmanned air vehicles developed for reconnaissance and surveillance purposes were the converted target vehicles mentioned above. Targets, however, are usually high performance, high speed, highly maneuverable aircraft designed to provide a realistic threat simulation for high performance manned aircraft or ground gunnery crews. Their missions are usually of short duration, and fuel efficiency is not a high priority.

Reconnaissance and surveillance missions, on the other hand, usually require longer range, longer duration flights with

greater fuel economy. They also require sufficient interior space and load carrying capacity to accommodate the complex electronic and optical instrument packages needed for surveillance. The answer has been to design and build entirely different unmanned aircraft for these missions. This is exactly what Teledyne Ryan Aeronautical has done in the development of its two new unmanned air vehicles, specifically designed for reconnaissance/surveillance and related unmanned missions such as electronic countermeasures. These new UAVs, the Model 324, a jet powered, high subsonic vehicle, and the Model 410, a propeller-driven long range, long endurance vehicle are described below.

The New Ryan Model 324

The Model 324 is a high speed medium range UAV designed specifically for military photoreconnaissance and related missions. It is designed to carry a 250 pound equipment package over a range of 1700 nautical miles at speeds of up to Mach 0.8. (This is approximately 460 knots at an altitude of 40,000 feet. See the Glossary for a fuller explanation of Mach numbers.) Four flight test vehicles have been produced and are undergoing tests at this time. Twenty-five additional vehicles will be produced under a present customer contract, beginning in early 1988.

The 20-foot long airframe of the Model 324 is an all-composite structure built primarily of Kevlar-epoxy materials. It has a 12-foot wingspan. The design of the airframe reflects the configuration of the earlier Teledyne Ryan Compass Arrow and Compass Cope RPVs which had turbine engines mounted on top of the fuselage. This is in contrast to the Firebee configuration with its engine located at the bottom of the forward part of the fuselage. The new configuration frees the forward part of the aircraft for a variety of sensor packages, including downward and forward looking infrared or aerial cameras, and is ideal for a reconnaissance-type vehicle.

Teledyne CAE Turbojet Power

The 324 is powered by the Model 373-8C engine designed and built by Teledyne

Teledyne Ryan's new Model 324 is a high speed, medium range Unmanned Air Vehicle designed specifically for military photoreconnaissance and related missions. The complete 324 system includes a transporter/launch trailer and an 8-wheel, all-terrain tractor that incorporates the system's command and control center and provisions for a three-man crew.

CAE. It produces 970 pounds of static thrust at sea level. The fully laden vehicle, which weighs 2,500 pounds including a 150 gallon fuel load, is launched from a transporter/launch trailer with the assist of a jettisonable launch booster rocket that helps boost the vehicle to flight speed within four seconds.

Recovery is accomplished via a two-stage parachute system and an airbag system that deploys from the bottom of the vehicle to absorb impact forces when the vehicle touches down. The launch trailer is equipped with a crane for lifting the UAV back onto its launch/transport trailer.

During recent flight tests, the 324 flew for more than two and one half hours at altitudes of more than 38,000 feet and speeds in excess of Mach 0.76. Maximum design altitude for the vehicle as it is presently configured is 45,000 feet.

324 Ground Support System

In addition to the 6-wheel trailer on which the UAV is transported and from which it is launched, the 324 ground system includes an 8-wheel, all-terrain tractor incorporating an air conditioned command and control center that houses all the electronic equipment required for launching, controlling and recovering the UAV. The system is designed for operation by a three-man crew. The tractor/transporter system has a top speed on hard surfaces of 52 miles per hour and a range of about 300 miles. It is designed, however, for off-road use in sand and other types of difficult terrain. All 8 wheels of the tractor are driving wheels, and the 6 trailer wheels can also be used as drivers at the option of the operator. Tire pressure of individual wheels can be increased or decreased by the driver to suit the terrain. During high speed travel on hard surfaces the middle wheels on both the tractor and trailer can be raised from the ground. Three of these ground systems will be provided to the customer with the initial production order of 29 vehicles.

Teledyne Ryan's New Mission Logic Control Unit

An outstanding feature of the 324 system is the Mission Logic Control Unit (MLCU)

Left: The Model 324 UAV is recovered at the end of its mission by means of a two-stage parachute system and an airbag system that deploys from the bottom of the vehicle to absorb impact forces when the vehicle touches down. (Airbags not yet deployed in this photograph.) The Model 324's ground support tractor trailer system is equipped with a crane for recovering the vehicle.

Left center: Powered by a 970-pound static thrust Teledyne CAE Model 373-8C turbojet engine, the Ryan Model 324 Unmanned Air Vehicle is brought up to flight speed within four seconds of launch with the assistance of a jettisonable booster rocket (bottom rear of fuselage). In recent flight tests the vehicle flew for more than two and one half hours at altitudes of over 38,000 feet, and speeds in excess of Mach 0.77.

Model 324: Turbojet, High Speed, High Altitude, Rocket Launched, Unmanned Aircraft.

Teledyne Ryan's new Model 324 is ground launched, with the assistance of a jettisonable booster rocket, from its Launch/Recovery Vehicle. Capable of a wide variety of mission profiles, the Model 324 is designed to carry a 250 pound equipment package over a range of 1700 nautical miles at speeds of up to Mach 0.8. Maximum design altitude for the vehicle as it is presently configured is 45,000 feet.

A Mission Logic Control System (MLCU) developed by Teledyne Ryan Aeronautical permits the vehicle to fly complex autonomous missions. The MLCU is an on-board digital computer that utilizes four microprocessors and adequate memory capacity to control and coordinate all functions of the aircraft and its reconnaissance equipment.

It can be programmed with more than 100 predetermined waypoints prior to launch, and automatically carry out an entire selected mission from launch to recovery. Navigational data is provided by an inertial reference system that is updated with information from the U.S. Global Positioning System, a satellite system that provides precise earth location data. When within range of the command and control center located in the ground transporter tractor, it can be flown by remote command. The Model 324 is recovered by a two-stage parachute system and an airbag system that deploys from the bottom of the aircraft to absorb impact forces when it touches down.

Model 324 is launched from the Launch/Recovery Vehicle.

Model 410: Propeller Driven, Conventional Landing and Take Off, Long Flight Duration, Unmanned Aircraft.

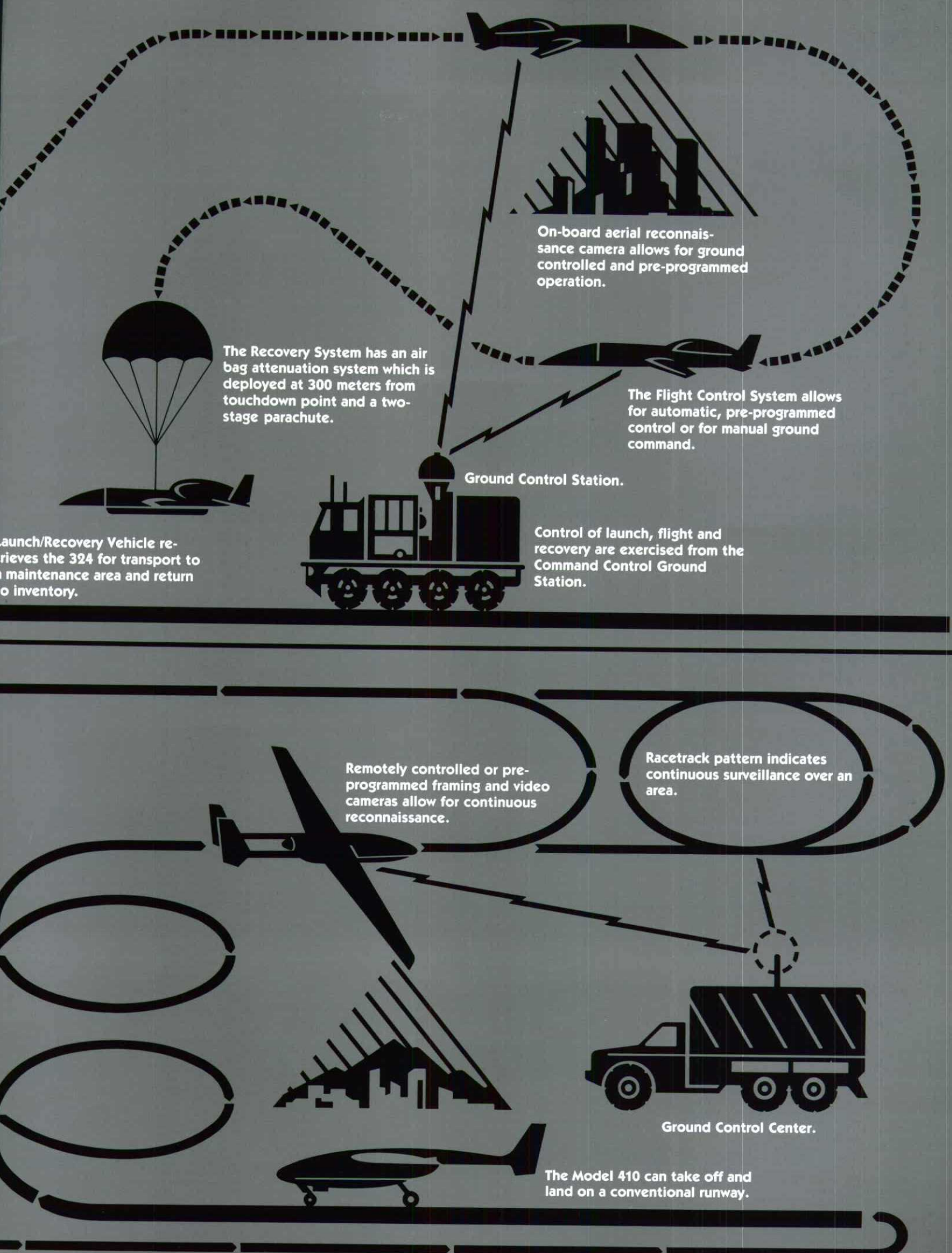
The Teledyne Ryan-developed Model 410 is propeller driven and designed for the exceptionally long endurance and high load carrying capability needed for extended reconnaissance and surveillance missions. Using a conventional tricycle landing gear with retractable nose wheel, and high efficiency flaps, the 410 can take off and land on unimproved airstrips or roads as short as 750 feet. It can carry a maximum equipment load of 1000 pounds in a 24 cubic foot equipment bay.

The Model 410 can stay aloft for 80 hours at a cruise speed of 100 knots carrying a 100 pound equipment load. This exceptionally high endurance permits either great range or extended loiter capability or combinations of the two. The 410 thus provides this vital capability for cost effective military reconnaissance as well as civilian surveillance of coastlines, borders or other sensitive areas.

Its maximum air speed is 190 knots, and, as presently configured with a 2:1 turbocharger ratio, it can fly at an altitude somewhat above 30,000 feet. With optional higher ratio turbocharging its service ceiling can be increased to 45,000 feet.

The Model 410 is equipped to fly autonomous missions beyond the range of ground controllers, or can be flown as a remotely piloted vehicle with a direct data link.

Vehicle can remain aloft over three days, depending on the payload weight.


On-board aerial reconnaissance camera allows for ground controlled and pre-programmed operation.
The Recovery System has an air bag attenuation system which is deployed at 300 meters from touchdown point and a two-stage parachute.
The Flight Control System allows for automatic, pre-programmed control or for manual ground command.
Ground Control Station.
Control of launch, flight and recovery are exercised from the Command Control Ground Station.
aunch/Recovery Vehicle re-rieves the 324 for transport to maintenance area and return o inventory.
Remotely controlled or pre-programmed framing and video cameras allow for continuous reconnaissance.
Racetrack pattern indicates continuous surveillance over an area.
Ground Control Center.
The Model 410 can take off and land on a conventional runway.

developed by Teledyne Ryan Aeronautical. This is a digital computer utilizing four microprocessors and a large amount of memory capacity to control and coordinate all functions of the aircraft during its mission. It can be programmed with more than 100 predetermined waypoints prior to launch and automatically carry out an entire selected mission from launch to recovery. The payload sensor package, propulsion, fuel and electrical systems, command and guidance, and recovery system are all under the control of this central logic system.

Navigational data is provided by an inertial reference system that is updated with information from the U.S. Global Positioning System (GPS), a satellite system that provides precise earth location data. When the vehicle is within range of its ground control base it can also be controlled by means of a C-band command and control system.

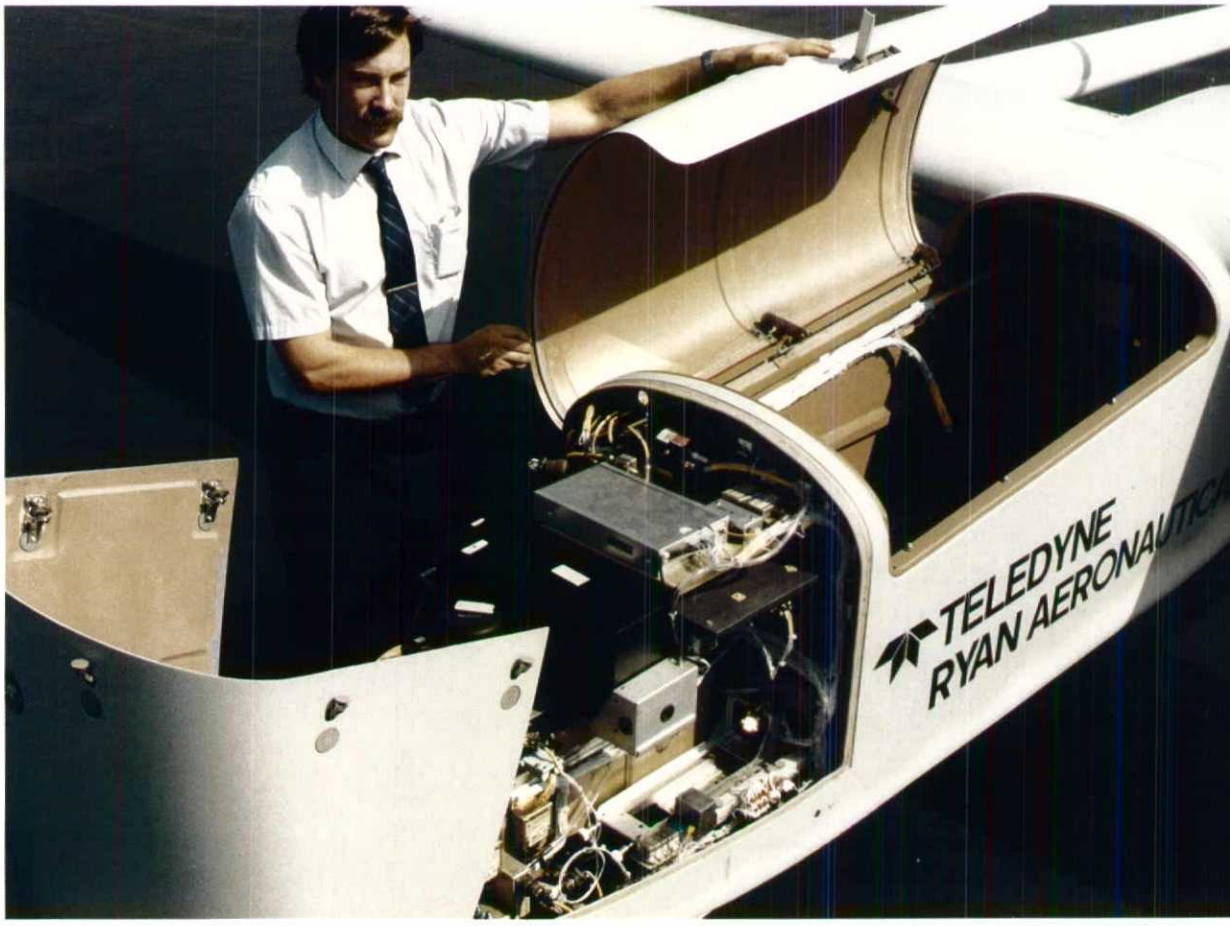
Other Teledyne Participation

In addition to Teledyne Ryan Aeronautical and Teledyne CAE, five other Teledyne companies are participating in the Model 324 program. Teledyne Ryan Electronics is responsible for the navigation subsystem which includes the GPS and inertial systems. Teledyne McCormick Selph provides the Safe/Arm pyrotechnic device for starting the booster. Teledyne Micronetics (now part of Teledyne Ryan Electronics) carried out antenna range testing. Teledyne Republic provided hydraulic valves for the Launch/Recovery Vehicles. And Teledyne Brown Engineering conducted an extensive audit of the system software and flight simulation effort.

The present $60 million contract for the Model 324 includes up to 14 months of on-site training for customer personnel that will be carried out by Teledyne Ryan Aeronautical.

The New Ryan Model 410 UAV

The new Model 410 is also designed primarily for reconnaissance and surveillance missions, but the similarity to the Model 324 ends there. The Model 410 is a large, propeller driven UAV, powered with a highly reliable, off-the-shelf 160



The Model 410 UAV can carry 1000 pounds of equipment in its 24 cubic foot equipment bay. This capacity is exceptionally large for an unmanned air vehicle. The 410's engine is rear mounted in a pusher configuration which frees the forward fuselage for its large equipment bay and permits optical or electronic sensors to be mounted in any position.

horsepower turbocharged general aviation gasoline engine. Its maximum airspeed is 190 knots, and it can take off and land on roads or unimproved air strips of 750 feet, using conventional landing gear and highly efficient flaps.

As the engine is presently configured, with a 2:1 turbocharger ratio, the aircraft can fly at a maximum altitude somewhat above 30,000 feet. With optional higher ratio turbocharging, available off-the-shelf from general aviation sources, the 410's service ceiling can be increased to 45,000 feet.

Speed and high performance have been traded off for something much more vital in reconnaissance/surveillance missions: range, endurance and load carrying capacity. The 30-foot wingspan Model 410 has a maximum load carrying capacity of 1000 pounds in a 24 cubic foot equipment bay. Both these figures are exceptionally large for an unmanned vehicle.

Though it does not compare in speed with jet powered UAVs, the Model 410 is far from a slow aircraft. Its top speed of 190 knots is more than adequate to cope with the 100 knot winds that are frequently encountered at 30,000 feet and above.

Using a wet wing design (fuel compartments in the wings) for maximum fuel capacity, the Model 410 can stay aloft for 80 hours (more than 3 days) at a cruise speed of 100 knots carrying a 100 pound equipment load. Much larger payloads can be carried with a commensurate reduction in fuel and endurance.

The engine is rear mounted in a pusher configuration, which frees the forward fuselage for its large capacity equipment bay and permits sensors to be mounted in any position. The nose wheel of the tricycle landing gear retracts to avoid interferrence with forward-looking sensors.

In Search of the Multi-Purpose UAV

The Model 410 is a company funded development based on two years of worldwide research on the capabilities of RPVs and UAVs currently offered on the world market by many countries, and the needs and applications of users of these vehicles. The first phase of this study revealed that unmanned vehicles were being used at only a

The new Teledyne Ryan Model 410 is a large, propeller driven UAV designed for extremely long endurance and heavy load carrying capacity vital in extended reconnaissance and surveillance missions. The 30-foot wingspan craft with a maximum airspeed of 190 knots lands and takes off using conventional landing gear. The Model 410 is designed to stay aloft for 80 hours (more than 3 days) at a cruise speed of 100 knots carrying a 100-pound equipment load.

small fraction of their potential. None of the existing systems, for example, provided a practical means of conducting sustained surveillance at an affordable cost.

The second phase of the research involved exhaustive analysis of over 100 types of missions for UAVs, coupled with studies of the trade-offs required in vehicle design to accommodate the majority of these missions. This research was based on extensive interviews and discussions with customer audiences throughout the world.

What emerged from this research was a real need for full-time, all-weather surveillance of borders, coastlines and vast land and sea areas. Large payload space and weight carrying ability were seen to be necessary to carry an array of multiple, flexible imaging equipment. Military needs included the classic strategic and tactical needs for intelligence, particularly cost effective, round-the-clock surveillance.

Non-Military Uses for the Model 410

Considerable interest was also found among non-military government agencies and potential commercial users. Applications such as border patrol to control illegal immigration, smuggling, drug running and terrorist activities, as well as search-and-rescue and disaster control were all cited as areas where unmanned vehicles could provide the only cost effective way of providing full-time large area coverage.

Commercial and scientific interests cited atmospheric monitoring, forest and crop surveys, forest fire control, fishing territory monitoring and protection, and similar activities that require long duration, cost effective surveillance.

A Bird for All Seasons

The Model 410 was carefully designed and produced to meet these types of broad applications. Moderate initial cost, low operational cost, simple maintenance, all-weather, day/night operation, conventional landing/takeoff, long range and endurance, high service ceiling, and large load carrying capacity all contribute to its versatility.

The 410's larger payload capacity permits standard sensor equipment to be used. This equipment can be procured for half the price of the miniaturized sensors required in the smaller mini-RPVs that are currently popular. On a one to one basis, the acquisition cost of a Model 410 is about equivalent to that of a mini-RPV. But procuring and fielding a 410 system to provide continuous coverage of an area can be achieved at about one tenth the cost of using mini-RPVs. Operating and maintenance costs would be about one-fifth.

Advanced Composite Construction

The 410 airframe is made using a high density structural foam layer between fiberglass-epoxy skins, a technique used in building high performance sailplanes. Wing spars and landing gear are graphite-epoxy composite.

On the ground one man can remove and stow the wings in a matter of minutes, reducing the vehicle to an 8-foot width that permits it to be towed on highways on a conventional trailer. Turnaround time between flights is limited to the time it takes to refuel and replenish any other stores required for the mission.

Sophisticated Control and Data Handling

The flight control can store multiple mission programs and can be reprogrammed in flight, or controlled from a base station when it is within range. The system provides excellent data link range which can be supplemented by relaying data through land, sea or air vehicles, including other 410s. Satellite link can be provided for real-time data transmission, and on board data recording is a standard feature. The ground control center permits two men to monitor eight 410s and their sensors through a two-way, long range data link.

The Age of UAVs

Teledyne Ryan Aeronautical's two new UAVs, the Model 324 and the Model 410 are the first of a new generation of highly versatile, task-oriented unmanned air vehicles that offer an efficient and cost effective solution for a wide variety of difficult military and civilian reconnaissance and surveillance missions.

NEW MISSIONS FOR VETERAN RPVs.

In 1961, Teledyne Ryan Aeronautical was awarded a military contract to modify four Firebee I drone target vehicles for use as remotely piloted photoreconnaissance vehicles. Designated the Model 147 series, these vehicles were the first in a long series of variants developed for special missions over the next ten years. Hundreds of these vehicles were built and flew more than 3000 vital and successful reconnaissance missions over hostile territory during the Vietnam conflict.

Many of these Model 147 series RPVs still exist in military inventories. Now, a new use has been found for them in testing and perfecting the readiness of new U.S. coastal and northern defense radars that are being deployed to counter the threat of the new generation of cruise missiles.

Cruise missiles are small air-breathing missiles designed to fly long distances at subsonic speeds. They can be launched from ships, submarines and aircraft as well as from the ground. One of the dangerous threats of this type of missile is their ability to fly at very low altitudes (as well as high altitudes) and thus evade defense radars until they have reached their targets.

A new generation of Over-The-Horizon-Backscatter (OTH-B) radars is now being deployed along the east coast of the United States to counter this threat. A similar system called the North Warning System (NWS) is also now being deployed in Alaska. These systems provide long range detection of targets at ranges from 500 to 2500 miles. Unlike conventional radars, which usually detect direct reflections of radar energy from a target, backscatter radars detect target reflections that have been further reflected or refracted from beyond the horizon by various ionized layers in the atmosphere. This permits backscatter-type radar to detect low flying objects at great distances.

The first installation of a new OTH-B radar system has been made at Bangor, Maine and is ready for operational testing. Teledyne Ryan Aeronautical was awarded a contract in May of 1987 to modify a number of the 147 series RPVs, known in military designation as the AQM34M, for use in simulating the threat of hostile cruise missiles. During this program, known as the Small Target Test System (STTS), the RPVs will be air launched from NC130H mother aircraft in the vicinity of Puerto Rico and fly various trajectories toward the Bangor radar, at altitudes ranging from 500 feet to 25,000 feet.

After missions of about three hours covering distances of up to 1100 nautical miles, the RPVs will be recovered from the sea in the vicinity of Bermuda. Forty-eight flights are planned over a twelve week period.

The STTS contract received by Teledyne Ryan Aeronautical involves three phases. The first was the refurbishment and modification of ten AQM34M RPVs for operational use, and an additional three for use as spares. These vehicles, which have been in military storage for ten years or more, were found to be in excellent, flight-ready condition. The required modifications, including the installation of external fuel tanks to provide the necessary range and endurance for the OTH-B test flights, have been carried out and six demonstration flights have been completed.

The second phase of the contract has been to train military personnel in flying and maintaining these vehicles. Preliminary training has been completed. The third phase is to deploy the vehicles to Puerto Rico and carry out the test flights against the OTH-B radar. Flights are expected to begin in the spring of 1988.

In addition to the thirteen RPVs, Teledyne Ryan Aeronautical is refurbishing two Microwave Command Guidance Systems, one Air Director System which will control the aircraft from aboard the NC130H launch aircraft, and a variety of other support equipment.

North Warning System

A second contract was also awarded to Teledyne Ryan Aeronautical for a similar program designed to test the effectiveness of another new radar system being installed at Barter Island, Alaska. Named the North Warning System (NWS), this radar is designed to provide detection of cruise missile threats approaching from the north.

As in the OTH-B program, Model 147 RPVs now in military stock are to be modified to present a realistic cruise missile threat simulation. In this case, a different version RPV designated the AQM34L is to be modified. These RPVs were originally outfitted differently and had a different range than the M version.

These vehicles are to be modified to present a reduced radar cross-section that more closely simulates the radar cross-section of a cruise missile. The test missions to be flown will be at low altitude only with shorter flight duration and distances.

One of these RPVs has already been modified and has passed radar cross-section testing. Seven more will be modified and ready by March 1988. After demonstration flights, they will be deployed to Barter Island, Alaska for approximately 15 operational flights in mid to late summer of 1988. Support equipment, including the Microwave Command Guidance System and Air Director System will also be provided.

Future Programs

As other installations in the new air defense system are activated, there is the possibility of similar Small Target Test System programs being instituted. There has also been interest expressed in the use of these battle-proven Teledyne Ryan RPVs for use in their original role as reconnaissance vehicles, when they are not engaged in cruise missile threat simulation.

These new programs are indicative of the continuing interest in and value of remotely piloted and unmanned air vehicles ranging from the veteran Teledyne Ryan RPVs described above to the new Model 324 and 410 reconnaissance aircraft introduced in this report.

The AQM34M RPV, suspended beneath a wing prior to launch.

Kettering Bug

Firebee I

A Brief History of Remotely Piloted Vehicles

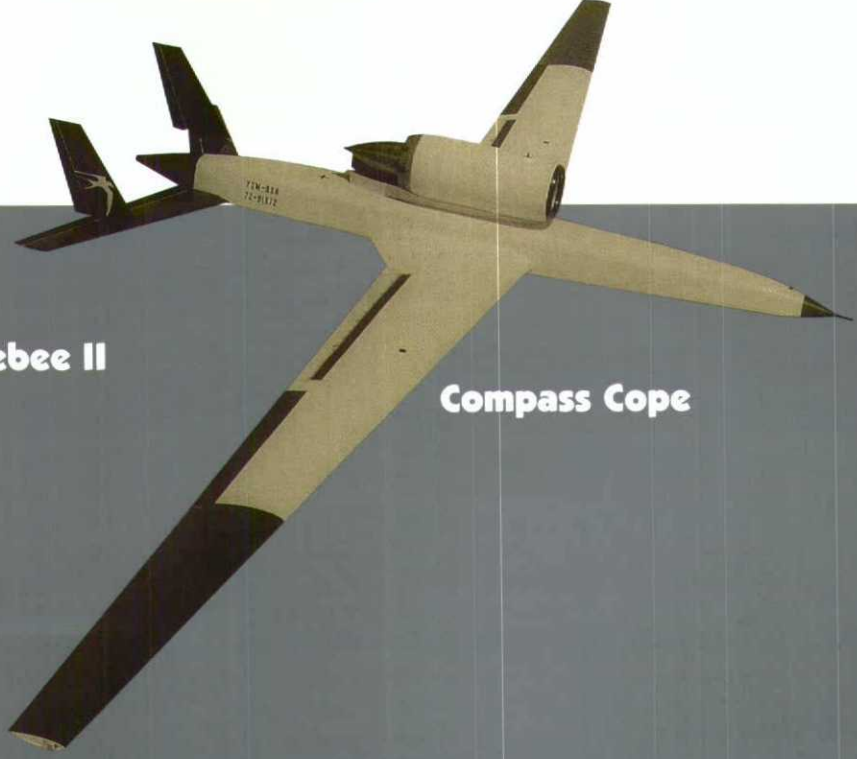
The history of unmanned aircraft, ranging from models to larger vehicles, is closely intertwined with the development of manned flight. One of the first unmanned vehicles, however, to be developed with some greater purpose than simply demonstrating flight, was the Kettering Bug, built during World War I. This small piston engined biplane was designed to be filled with explosives and flown along a straight course to its target. Though unmanned, it was more a missile than an RPV, since there was no provision for controlling or guiding it once it was launched. It was never used.

The idea of radio control came later, when electronic technology had advanced a bit. In 1928 a full size aircraft, a Curtis Robin, was equipped with radio control and flown as a true RPV in demonstration flights for several years. Further experiments were carried out in the 1930s with other full-scale aircraft, and in World War II B-17 and B-24 bombers were filled with explosives and flown by radio control against targets in Germany.

Later, radio control techniques were further improved and many full scale manned aircraft, including F-4s, B-47s, F-80s, F-86s, and F-104s, among others, were flown as drones.

The real era of RPVs began when the focus changed from converting manned aircraft to designing and building aircraft intended solely for use as RPVs. An early effort along these lines was in the 1940s when thousands of small propeller-driven target drones were built for use by the military as targets for training pilots and gun crews.

Firebee II



Compass Cope

Compass Arrow

Firebolt

In 1948, with the advent of jet aircraft, Teledyne Ryan Aeronautical received a contract to develop a jet-powered, high speed subsonic target drone. Its first successful flight came in 1951, and by 1958 the company had built nearly 1300 of these RPVs. This vehicle, which went through a number of upgrades as technology progressed, became known as the Firebee I, perhaps the most successful RPV design ever created. Still in production today, nearly 40 years later, more than 6500 have been produced, and have flown an estimated 32,000 operational missions.

During the Vietnam conflict, the basic Firebee I vehicle was modified for use by the military to carry out photo reconnaissance, electronic warfare and decoy missions deep into hostile territory. Designated the TRA Model 147 series, a number of variants were made to customize them for special missions. Hundreds of this series were built and flew more than 3000 vitally important combat sorties in that conflict.

In addition to these, Teledyne Ryan Aeronautical has developed and built numerous other RPVs including the high altitude long endurance Compass Cope and Compass Arrow vehicles, the Mach 1.8 Firebee II and the Mach 4.0 Firebolt.

Now, Teledyne Ryan is introducing two new UAVs, described in this report, the Model 324 and Model 410 that continue the evolution of these extremely useful aircraft.

Net income for 1987 was $377.2 million or $32.25 per share compared to $238.3 million or $20.35 per share for 1986. Sales were $3.22 billion in 1987 compared to $3.24 billion in 1986.

Net income for the fourth quarter of 1987 was $158.8 million or $13.60 per share compared to $47.0 million or $4.01 per share for the fourth quarter of 1986. Sales were $807.9 million for the fourth quarter of 1987 compared to $834.8 million for the same period in 1986.

Net income for the year and quarter ended December 31, 1987 includes gains on sales of investments of $108.1 million and $76.7 million, respectively, compared to $17.2 million and $4.3 million for the same periods of 1986. Of the gains on sales of investments for the year and quarter ended December 31, 1987, $104.8 million and $72.2 million were included in equity in net income of unconsolidated subsidiaries and $3.3 million and $4.5 million were included in income of consolidated companies. Substantially all of the gains in 1986 were included in equity in net income of unconsolidated subsidiaries.

Net income includes a credit, after tax, of $16.2 million and $4.2 million related to pension for the year and quarter ended December 31, 1987, compared to pension expense, net of tax, of $25.2 million and $6.3 million for the year and quarter ended December 31, 1986. During the first quarter of 1987, Teledyne changed its method of accounting for pension expense, as required by Financial Accounting Standards Board Statement No. 87.

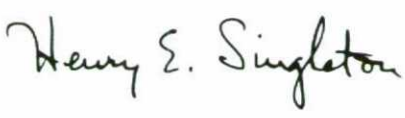
Income of consolidated companies for the quarter ended December 31, 1987 includes gains of $6.6 million, after tax, on the sale of property and equipment.

Equity in net income of investees was $33.6 million in 1987 compared to $16.9 million in 1986 (including a loss of $9.4 million representing Teledyne's equity in a net loss reported by Litton for its quarter ended April 30, 1986). Equity in net income of investees was $9.6 million for the fourth quarter of 1987 compared to $7.2 million for the same period in 1986.

Equity in net income of unconsolidated subsidiaries for 1986 includes equity in net income of Argonaut Group of $16.5 million. Argonaut Group was spun-off September 30, 1986.

A cash dividend for the quarter ended December 31, 1987 of $1.00 per share was paid on November 18, 1987 to shareholders of record November 4, 1987.

Revenue and operating profit by business segment are shown in Note 13 to the financial statements on page 30. Management's Discussion and Analysis of Financial Condition and Results of Operations is presented on page 38.



Chairman of the Board of Directors

President and Chief Executive Officer

(In millions except per share amounts)

Year	*Sales*	*Net Income*	*Net Income Per Share*	*Assets*	*Shareholders' Equity*
1987	**$3,216.8**	**$377.2**	**$32.25**	**$3,135.0**	**$1,976.0**
1986	**3,241.4**	**238.3**	**20.35**	**2,744.2**	**1,636.6**
1985	**3,256.2**	**546.4**	**46.66**	**2,775.4**	**1,577.4**
1984	**3,494.3**	**574.3**	**37.69**	**2,790.7**	**1,159.3**
1983	**2,979.0**	**304.6**	**14.87**	**3,852.2**	**2,641.2**
1982	**2,863.8**	**269.6**	**13.05**	**3,290.7**	**2,111.1**
1981	**3,237.6**	**421.9**	**20.43**	**2,904.5**	**1,723.2**
1980	**2,926.4**	**352.4**	**15.62**	**2,575.9**	**1,410.2**
1979	**2,705.6**	**379.6**	**15.02**	**2,050.8**	**1,288.6**
1978	**2,441.6**	**254.4**	**9.63**	**1,588.2**	**890.3**
1977	**2,209.7**	**201.3**	**7.53**	**1,443.1**	**702.2**
1976	**1,937.6**	**137.6**	**4.78**	**1,228.5**	**516.1**
1975	**1,715.0**	**101.7**	**2.57**	**1,136.5**	**489.3**
1974	**1,700.0**	**31.5**	**0.55**	**1,108.9**	**477.8**
1973	**1,455.5**	**66.0**	**1.01**	**1,227.4**	**532.8**
1972	**1,216.0**	**59.3**	**0.67**	**1,127.8**	**484.0**
1971	**1,101.9**	**57.4**	**0.62**	**1,064.8**	**606.1**
1970	**1,216.4**	**61.9**	**0.69**	**952.6**	**576.3**
1969	**1,294.8**	**58.1**	**0.68**	**938.1**	**502.0**
1968	**806.7**	**40.3**	**0.56**	**602.4**	**316.5**
1967	**451.1**	**21.3**	**0.38**	**336.7**	**152.6**
1966	**256.8**	**12.0**	**0.29**	**170.4**	**90.2**
1965	**86.5**	**3.4**	**0.16**	**66.5**	**34.8**
1964	**38.2**	**1.4**	**0.10**	**35.0**	**13.7**
1963	**31.9**	**0.7**	**0.06**	**23.9**	**8.6**
1962	**10.4**	**0.2**	**0.02**	**10.8**	**3.5**
1961	**4.5**	**0.1**	**0.01**	**3.7**	**2.5**

As reported in the Company's annual reports, adjusted for stock dividends and splits. Years 1967 through 1982 were restated for certain accounting changes.

Consolidated Balance Sheets

December 31, 1987 and 1986
(In millions)

	1987	1986
ASSETS		
Current Assets:		
Cash and marketable securities	**$ 244.8**	$ 116.8
Receivables	**408.3**	384.7
Inventories	**244.0**	211.0
Deferred income taxes	**43.3**	27.2
Prepaid expenses	**10.8**	10.2
Total current assets	**951.2**	749.9
Investments in Unconsolidated Subsidiaries	**1,810.5**	1,625.5
Property and Equipment	**308.7**	325.3
Other Assets	**64.6**	43.5
	$3,135.0	$2,744.2
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current Liabilities:		
Accounts payable	**$ 170.1**	$ 137.3
Accrued liabilities	**258.7**	247.0
Accrued income taxes	**16.2**	29.9
Current portion of long-term debt	**2.7**	2.4
Total current liabilities	**447.7**	416.6
Long-Term Debt	**547.9**	572.7
Deferred Income Taxes	**89.6**	78.8
Other Long-Term Liabilities	**73.8**	39.5
Shareholders' Equity	**1,976.0**	1,636.6
	$3,135.0	$2,744.2

The accompanying notes are an integral part of these balance sheets.

Consolidated Statements of Income

For the Years Ended December 31, 1987, 1986 and 1985
(In millions except per share amounts)

	1987	1986	1985
Sales	**$3,216.8**	$3,241.4	$3,256.2
Costs and Expenses:			
Cost of sales	**2,460.6**	2,542.2	2,529.2
Selling and administrative expenses	**446.4**	455.9	437.9
Interest expense	**16.2**	20.5	26.0
Interest and dividend income	**(12.7)**	(7.2)	(15.6)
Gains on sales of securities	**(6.2)**	(0.3)	(36.7)
	2,904.3	3,011.1	2,940.8
Income before Income Taxes	**312.5**	230.3	315.4
Provision for Income Taxes	**128.4**	101.2	132.8
Income of Consolidated Companies	**184.1**	129.1	182.6
Equity in Net Income of Unconsolidated Subsidiaries:			
Before gains on sales of investments, Argonaut Group and Litton distribution	**88.3**	75.7	69.3
Gains on sales of investments	**104.8**	17.0	148.6
Argonaut Group	**—**	16.5	64.2
Litton distribution	**—**	—	81.7
	193.1	109.2	363.8
Net Income	**$ 377.2**	$ 238.3	$ 546.4
Net Income Per Share	**$ 32.25**	$ 20.35	$ 46.66

The accompanying notes are an integral part of these statements.

Consolidated Statements of Changes in Financial Position

For the Years Ended December 31, 1987, 1986 and 1985
(In millions)

	1987	1986	1985
Working Capital was Provided by:			
Net income	**$377.2**	$238.3	$ 546.4
Equity in net income of unconsolidated subsidiaries (before allocated interest expense and income tax items):			
United, Trinity and other	**(219.5)**	(122.9)	(265.8)
Argonaut Group	**—**	(12.7)	(53.2)
Depreciation and amortization of property and equipment	**97.3**	107.7	111.9
Change in prepaid pension cost	**(22.4)**	—	—
Change in deferred income taxes	**10.4**	(14.4)	(63.2)
Other charges not affecting working capital	**(1.3)**	5.9	6.1
Working capital provided by operations	**241.7**	201.9	282.2
Dividends, advances from and repayments of advances to United, Trinity and Fireside	**87.0**	70.6	91.5
Decrease in investments and advances due to distribution of Argonaut Group	**—**	212.3	—
Repayments of advances to Argonaut Group	**—**	—	22.5
Other	**39.6**	13.4	7.3
	368.3	498.2	403.5
Working Capital was Applied to:			
Additions to property and equipment	**82.0**	100.5	115.6
Reduction in long-term debt	**35.5**	104.3	408.0
Cash dividends	**46.8**	—	—
Acquisition and retirement of stock	**14.5**	—	—
Distribution of Argonaut Group	**—**	217.2	—
Other	**19.3**	18.4	12.8
	198.1	440.4	536.4
Increase (Decrease) in Working Capital	**$170.2**	$ 57.8	$(132.9)
Increase (Decrease) in Working Capital:			
Cash and marketable securities	**$128.0**	$ 49.5	$(130.7)
Receivables	**23.6**	(36.9)	(6.2)
Inventories	**33.0**	38.4	35.9
Deferred income taxes	**16.1**	17.8	12.7
Prepaid expenses	**0.6**	(1.8)	1.3
Accounts payable	**(32.8)**	(11.3)	9.7
Accrued liabilities	**(11.7)**	(18.7)	(14.3)
Accrued income taxes	**13.7**	21.3	(41.4)
Current portion of long-term debt	**(0.3)**	(0.5)	0.1
	$170.2	$ 57.8	$(132.9)

The accompanying notes are an integral part of these statements.

Consolidated Statements of Shareholders' Equity

For the Years Ended December 31, 1987, 1986 and 1985
(In millions except share and per share amounts)

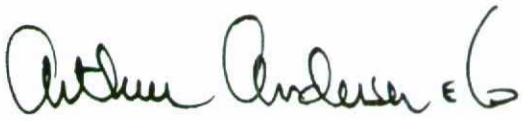
	Common Stock	*Additional Paid-In Capital*	*Retained Earnings*	*Equity in Net Unrealized Appreciation*	*Currency Translation Adjustment*	*Shareholders' Equity*
Balance, December 31, 1984	$11.7	$83.2	$ 880.5	$187.8	$(3.9)	$1,159.3
Net income	—	—	546.4	—	—	546.4
Change in net unrealized appreciation	—	—	—	(129.4)	—	(129.4)
Currency translation adjustment	—	—	—	—	1.1	1.1
Balance, December 31, 1985	11.7	83.2	1,426.9	58.4	(2.8)	1,577.4
Net income	—	—	238.3	—	—	238.3
Distribution of Argonaut Group	—	—	(185.8)	(31.4)	—	(217.2)
Change in net unrealized appreciation	—	—	—	37.0	—	37.0
Currency translation adjustment	—	—	—	—	1.1	1.1
Balance, December 31, 1986	11.7	83.2	1,479.4	64.0	(1.7)	1,636.6
Net income	—	—	377.2	—	—	377.2
Change in net unrealized appreciation	—	—	—	19.0	—	19.0
Cash dividends ($4.00 per share)	—	—	(46.8)	—	—	(46.8)
Acquisition and retirement of stock (41,500 shares)	—	(0.3)	(14.2)	—	—	(14.5)
Currency translation adjustment	—	—	—	—	4.5	4.5
Balance, December 31, 1987	$11.7	$82.9	$1,795.6	$ 83.0	$ 2.8	$1,976.0

The accompanying notes are an integral part of these statements.

To the Shareholders and Board of Directors of Teledyne, Inc.:

We have examined the consolidated balance sheets of Teledyne, Inc. (a Delaware corporation) and subsidiaries as of December 31, 1987 and 1986, and the related consolidated statements of income, shareholders' equity and changes in financial position for the years ended December 31, 1987, 1986 and 1985. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We did not examine the consolidated financial statements of United Insurance Company of America and subsidiaries (Note 4). The investment in United Insurance Company of America and subsidiaries represents 42 percent in 1987 and 46 percent in 1986 of consolidated assets and the equity in its net income represents 29 percent in 1987, 31 percent in 1986 and 29 percent in 1985 of consolidated net income. These statements were examined by other auditors whose report has been furnished to us and our opinion, insofar as it relates to amounts included for United Insurance Company of America and subsidiaries, is based solely on the report of the other auditors. Additionally, we did not examine the financial statements of certain investee companies (Notes 1 and 7). The equity in net income of these investees, after taxes, represents 10 percent in 1987, 8 percent in 1986 and 7 percent in 1985 of consolidated net income. These statements were examined by other auditors whose reports have been furnished to us and our opinion, insofar as it relates to amounts included for these investees, is based on the reports of the other auditors.

In our opinion, based on our examinations and the reports of other auditors, the financial statements referred to above present fairly the consolidated financial position of Teledyne, Inc. and subsidiaries as of December 31, 1987 and 1986, and the results of their operations and the changes in their financial position for the years ended December 31, 1987, 1986 and 1985, in conformity with generally accepted accounting principles which, except for the change (with which we concur) in accounting for pension expense discussed in Note 11 to the consolidated financial statements, were applied on a consistent basis.



ARTHUR ANDERSEN & CO.

Los Angeles, California,
January 9, 1988.

Note 1. Summary of Significant Accounting Policies. *Principles of Consolidation.* The consolidated financial statements of Teledyne, Inc. include the accounts of all its subsidiaries except its insurance and finance subsidiaries. The investments in unconsolidated subsidiaries are accounted for by the equity method. All material intercompany accounts and transactions have been eliminated, including transactions between unconsolidated subsidiaries. Certain amounts for 1986 and 1985 have been reclassified to conform with the 1987 presentation.

Currency Translation. Balance sheet accounts of foreign subsidiaries are translated at current exchange rates. Income and expenses are translated at the average rate of exchange during the year. Gains or losses resulting from translation of foreign financial statements are included in shareholders' equity. Gains or losses on foreign currency transactions resulting from exchange rate changes, which are not material, are included in operations in the period in which they occur.

Net Income Per Share. The weighted average number of shares of common stock used in the computation of net income per share was 11,693,660 in 1987 and 11,709,478 in 1986 and 1985.

Receivables. Receivables are presented net of a reserve for doubtful accounts of $8.0 million at December 31, 1987 and $8.4 million at December 31, 1986.

Inventories. Inventories are stated at the lower of cost (last-in, first-out and first-in, first-out methods) or market, less progress payments. Costs include direct material and labor costs and applicable manufacturing overhead. Sales and related costs are recorded as products are delivered and as services are performed, including those under long-term contracts. Costs relating to such long-term contracts are removed from inventory and charged to cost of sales at amounts approximating actual cost. Any foreseeable losses are charged to income when determined.

Other Investments. Investments held by Teledyne and its subsidiaries are accounted for by the equity method in the Company's consolidated financial statements when the aggregate voting percentage has exceeded 20 percent for one full quarter. Teledyne's voting percentage and share of earnings or losses of each investee company are determined using the most recent publicly available audited financial statements and subsequent unaudited interim reports. As a result, the amounts included in the results of operations of Teledyne represent amounts reported by the investee companies for periods ending two to three months earlier.

Depreciation and Amortization. Buildings and equipment are depreciated primarily on declining balance methods over their estimated useful lives. Leasehold improvements are amortized on a straight-line basis over the life of the lease. Maintenance and repair costs ($71.2 million in 1987, $78.0 million in 1986 and $77.2 million in 1985) are charged to income as incurred, and betterments and major renewals are capitalized. Cost and accumulated depreciation of property sold, retired or fully depreciated are removed from the accounts, and any resultant gain or loss is included in income.

Cost in Excess of Net Assets of Purchased Businesses. Other assets include cost in excess of net assets of purchased businesses of $27.9 million at December 31, 1987 and $28.0 million at December 31, 1986. Substantially all of this cost relates to businesses purchased prior to November 1970 and is not being amortized.

Research and Development. Company-funded research and development costs ($87.7 million in 1987, $84.6 million in 1986 and $95.0 million in 1985) are expensed as incurred. Costs related to customer-funded research and development contracts are charged to costs and expenses as the related sales are recorded.

Pension Expense. In 1987, the Company changed its method of accounting for pensions in accordance with Statement of Financial Accounting Standards (SFAS) No. 87, as discussed in Note 11.

Income Taxes. Provision for income taxes includes Federal, state and foreign income taxes. Deferred income taxes are provided for timing differences in the recognition of income and expenses and undistributed earnings of subsidiaries, except for a portion of the earnings arising from operations of United Insurance Company of America and subsidiaries (United) (Note 4) and Trinity Universal Insurance Company and subsidiaries (Trinity) (Note 5). Investment tax credits are being amortized over the estimated lives of the related assets.

Note 2. Inventories. Inventories at December 31, 1987 and 1986 were as follows (in millions):

	1987	*1986*
Raw materials and work-in-process	**$412.3**	$388.8
Finished goods	**62.4**	61.2
	474.7	450.0
Progress payments	**(230.7)**	(239.0)
	$244.0	$211.0

Inventories determined on the last-in, first-out method were $440.7 million at December 31, 1987 and $423.9 million at December 31, 1986. The remainder of the inventories was determined using the first-in, first-out method. Inventories stated on the last-in, first-out basis were $208.7 million and $187.1 million less than their first-in, first-out values at December 31, 1987 and 1986, respectively. These first-in, first-out values do not differ materially from current cost.

During 1987, 1986 and 1985, inventory usage resulted in liquidations of last-in, first-out inventory quantities. These inventories were carried at the lower costs prevailing in prior years as compared with the cost of current purchases. The effect of these last-in, first-out inventory liquidations was to increase net income by $2.1 million in 1987, $6.6 million in 1986 and $3.0 million in 1985.

Inventories related to long-term contracts were $206.6 million and $197.5 million at December 31, 1987 and 1986, respectively. Progress payments related to long-term contracts were $204.3 million and $218.1 million at December 31, 1987 and 1986, respectively.

Note 3. Investments in Unconsolidated Subsidiaries. Investments in unconsolidated subsidiaries at December 31, 1987 and 1986 were as follows (in millions):

	1987	*1986*
Investments in:		
United	**$1,341.8**	$1,261.9
Trinity	**386.1**	293.2
Other	**73.6**	66.9
Advances to unconsolidated subsidiaries	**9.0**	3.5
	$1,810.5	$1,625.5

United (Note 4) is a 99.2 percent owned subsidiary of Teledyne (98.4 percent owned in 1986). Trinity (Note 5) is a wholly-owned subsidiary of Teledyne. Investments in other include the Company's investment in Fireside Securities Corporation (Fireside) (Note 6), a wholly-owned subsidiary.

Equity in net income of unconsolidated subsidiaries for the years ended December 31, 1987, 1986 and 1985 was as follows (in millions):

	1987	*1986*	*1985*
Equity in net income of:			
United	**$106.1**	$ 68.2	$382.5
Trinity	**116.6**	27.5	106.4
Other	**3.8**	3.8	4.4
Incremental effect of equity accounting for investees	**(6.0)**	23.4	(227.5)
	220.5	122.9	265.8
Allocated interest expense	**(42.5)**	(49.2)	(56.4)
Income tax items:			
Consolidated tax return effect	**(2.1)**	1.8	(9.8)
Deferred taxes on incremental effect of equity accounting	**(1.4)**	(6.5)	79.5
Allocated interest expense	**18.6**	24.2	27.7
Undistributed earnings	**—**	(0.5)	(7.2)
	15.1	19.0	90.2
Equity in net income of Argonaut Group	**—**	16.5	64.2
	$193.1	$109.2	$363.8

Equity in net income of unconsolidated subsidiaries differs from amounts presented on a separate company basis (Notes 4 and 5) primarily due to the elimination of the effect of intercompany transactions.

During 1987, the Company's unconsolidated subsidiaries disposed of their investments in Kidde, Inc. and Reichhold Chemicals, Inc. as a result of tender offers for these companies. Since the investments in Kidde, Inc. and Reichhold Chemicals, Inc. held by these subsidiaries were accounted for by the equity method in the consolidated financial statements in prior years, the gains reflected by these subsidiaries were adjusted for income which was recognized previously by Teledyne. This adjustment is included in the incremental effect of equity accounting for investees. The gain on the disposition of these investments after the adjustment included in equity accounting was $97.9 million. The incremental effect of equity accounting in 1985 includes amounts related to the Litton distribution discussed below.

Interest expense was allocated to unconsolidated subsidiaries based on the ratio of the Company's average investment in unconsolidated subsidiaries to average total capital.

The income tax item for the consolidated tax return effect represents the difference between the income tax credit or provision on a consolidated basis and the amount recorded by the unconsolidated subsidiaries on a separate company basis.

Teledyne distributed to its shareholders all of the outstanding common stock of Argonaut Group effective September 30, 1986. Accordingly, equity in net income of Argonaut Group in 1986 and 1985, which includes amounts related to equity accounting, allocated interest expense and income tax items, is presented separately.

In 1985, certain of the Company's unconsolidated subsidiaries received a distribution of $323.5 million in Litton debentures in exchange for 3,600,000 shares of Litton common stock. Since the investment in Litton held by Teledyne and its subsidiaries is accounted for by the equity method in the consolidated financial statements, the distribution resulted in a reduction in the carrying value of Teledyne's investment in Litton common stock. Because the exchange did not significantly change Teledyne's ownership percentage in Litton, the distribution was treated as a dividend for income tax purposes. As a result, the income tax liability previously recorded on Teledyne's equity in Litton's net income exceeded the amount required by $81.7 million, excluding amounts related to Argonaut Group. Accordingly, the 1985 income effect of the Litton distribution results from a reduction of $81.7 million in taxes provided on the equity in net income of unconsolidated subsidiaries.

The Company's investment exceeded its equity in net assets of its unconsolidated subsidiaries by $127.7 million in 1987 and 1986. Such excess is in addition to the excess included in the consolidated balance sheets and is not being amortized.

Note 4. United Insurance Company of America and Subsidiaries. The following condensed statements summarize the consolidated financial position and operating results of United Insurance Company of America and subsidiaries (in millions):

Consolidated Balance Sheets
December 31, 1987 and 1986

	1987	*1986*
Assets:		
Investments—other than investments in related parties:		
Fixed maturities, at amortized cost (market: 1987—$1,620.4; 1986—$1,476.8)	**$1,620.1**	$1,434.5
Equity securities, at market (cost: 1987—$225.1; 1986—$262.1)	**415.8**	461.4
Short-term investments	**15.9**	45.8
Other loans and investments	**75.0**	84.9
	2,126.8	2,026.6
Investments in related parties	**26.3**	10.3
Deferred policy acquisition costs	**129.5**	115.5
Other assets	**106.8**	103.9
	$2,389.4	$2,256.3
Liabilities and Shareholders' Equity:		
Policy reserves and liabilities	**$ 981.0**	$ 935.9
Long-term debt	**14.3**	14.3
Accrued and deferred Federal income taxes	**118.9**	92.9
Other liabilities	**68.2**	57.5
Shareholders' equity	**1,207.0**	1,155.7
	$2,389.4	$2,256.3

Consolidated Statements of Income
For the Years Ended December 31, 1987, 1986 and 1985

	1987	*1986*	*1985*
Premiums and Other Revenue:			
Premiums	**$443.1**	$451.5	$470.5
Net investment income	**144.9**	163.1	158.1
	588.0	614.6	628.6
Expenses:			
Benefits paid or provided	**278.4**	277.8	291.1
Underwriting, acquisition and other expenses	**249.6**	250.3	245.3
Provision for Federal income taxes	**18.2**	27.7	28.4
	546.2	555.8	564.8
	41.8	58.8	63.8
Gains on Sales of Investments	**67.7**	15.2	95.6
Litton Distribution	**—**	—	228.0
Net Income	**$109.5**	$ 74.0	$387.4

In November 1987, Unicoa Corporation was merged into its wholly-owned subsidiary, United Insurance Company of America. Each outstanding share of Unicoa Corporation's common stock was converted into one share of United's common stock.

Shareholders' equity includes retained earnings of $1.1 billion in 1987 and $1.0 billion in 1986. United intends to retain in the business and restrict from the payment of dividends 75 percent of retained earnings. Dividends of $32.5 million were paid to Teledyne in 1987.

Note 5. Trinity Universal Insurance Company and Subsidiaries. The following condensed statements summarize the consolidated financial position and operating results of Trinity Universal Insurance Company and subsidiaries (in millions):

Consolidated Balance Sheets
December 31, 1987 and 1986

	1987	*1986*
Assets:		
Investments—other than investments in related parties:		
Fixed maturities, at amortized cost (market: 1987—$512.8; 1986—$337.1)	**$ 512.4**	$329.8
Equity securities, at market (cost: 1987—$95.1; 1986—$135.1)	**393.3**	454.7
	905.7	784.5
Receivables	**93.6**	85.3
Deferred policy acquisition costs	**26.1**	24.5
Other assets	**13.2**	15.1
	$1,038.6	$909.4
Liabilities and Shareholder's Equity:		
Reserves for losses and loss adjustment expenses	**$ 240.7**	$192.0
Unearned premiums	**149.4**	143.4
Deferred income taxes	**87.3**	92.1
Other liabilities	**54.6**	26.4
Shareholder's equity	**506.6**	455.5
	$1,038.6	$909.4

Consolidated Statements of Income
For the Years Ended December 31, 1987, 1986 and 1985

	1987	*1986*	*1985*
Premiums and Other Revenue:			
Premiums	**$386.1**	$338.6	$293.8
Net investment income	**38.3**	39.4	48.6
	424.4	378.0	342.4
Expenses:			
Losses and loss adjustment expenses	**267.0**	235.8	227.7
Underwriting, acquisition and other expenses	**101.1**	91.5	83.7
Interest expense	**10.3**	12.4	14.9
Provision for Federal income taxes	**10.6**	15.0	1.2
	389.0	354.7	327.5
	35.4	23.3	14.9
Gains on Sales of Investments	**74.0**	77.0	44.5
Litton Distribution	**—**	—	32.4
Minority Interest	**—**	(22.8)	0.1
	109.4	77.5	91.9
Income Tax Reduction	**—**	29.8	5.4
Net Income	**$109.4**	$107.3	$ 97.3

Shareholder's equity includes retained earnings of $299.9 million in 1987 and $215.5 million in 1986. Trinity intends to retain in the business and restrict from the payment of dividends 75 percent of retained earnings. Dividends of $25.0 million and $47.8 million were paid to Teledyne in 1987 and 1986, respectively.

Note 6. Fireside Securities Corporation and Subsidiaries. The following condensed statements summarize the consolidated financial position and operating results of Fireside Securities Corporation and subsidiaries (in millions):

Consolidated Balance Sheets
December 31, 1987 and 1986

	1987	*1986*
Assets:		
Loans receivable, net of unearned discount	**$276.7**	$243.6
Marketable securities, at amortized cost, which approximates market	**33.8**	21.9
Other assets	**10.6**	15.2
	$321.1	$280.7
Liabilities and Shareholder's Equity:		
Investment certificates and passbook accounts	**$289.6**	$254.5
Other liabilities	**13.7**	9.5
Shareholder's equity	**17.8**	16.7
	$321.1	$280.7

Consolidated Statements of Income
For the Years Ended December 31, 1987, 1986 and 1985

	1987	*1986*	*1985*
Revenues:			
Interest on loans	**$50.2**	$41.9	$37.2
Other income	**4.3**	4.0	2.2
	54.5	45.9	39.4
Expenses:			
Interest on investment certificates and passbook accounts	**20.6**	18.0	16.8
General and administrative expenses	**30.1**	22.6	19.9
Provision for income taxes	**1.7**	2.6	1.3
	52.4	43.2	38.0
Net Income	**$ 2.1**	$ 2.7	$ 1.4

Dividends of $1.0 million and $9.1 million were paid to Teledyne in 1987 and 1986, respectively.

Note 7. Other Equity Investments. Certain investments held by Teledyne and its subsidiaries are included in the Company's consolidated financial statements using the equity method of accounting. These investments and approximate voting percentages based on the most recent publicly available data were: Curtiss-Wright Corporation (45 percent) and Litton Industries, Inc. (28 percent). Prior to the Argonaut Group distribution in 1986 (Note 3), other investments accounted for by the equity method were Brockway, Inc. (NY), Kidde, Inc. and Reichhold Chemicals, Inc.

Teledyne's equity in the net income of investees, including the effect of dividends and excluding amounts on shares held by Argonaut Group in 1986 and 1985 was $36.7 million in 1987, $24.8 million in 1986 and $48.4 million in 1985. Income taxes have been provided at appropriate rates for that portion of the equity in net income received as dividends; capital gains rates were used to compute the provision on the undistributed balance. The incremental effect of equity in net income of investees, excluding amounts on shares held by Argonaut Group in 1986 and 1985, was $33.6 million in 1987, $16.9 million in 1986 and $30.3 million in 1985. The 1986 amount includes a loss of $9.4 million representing Teledyne's equity in a net loss reported by Litton for its quarter ended April 30, 1986. The 1985 amount includes a loss of $23.6 million representing Teledyne's equity in Curtiss-Wright's loss on its investment in Western Union. In 1986 and 1985, equity in net income of investees included income of $1.0 million and $8.5 million, respectively, related to Brockway, Inc. (NY), Kidde, Inc. and Reichhold Chemicals, Inc.

Investments in Curtiss-Wright and Litton are carried at cost adjusted for Teledyne's equity in undistributed earnings since acquisition. This carrying value was $354.5 million and $302.5 million at December 31, 1987 and 1986, respectively, and the aggregate market value, based on quoted market prices, was $627.6 million and $645.7 million at December 31, 1987 and 1986, respectively. Teledyne's equity in the net assets of the investee companies exceeded the carrying value of the investments by approximately $34.1 million at December 31, 1987 and this difference is not being amortized; a portion of this amount has been considered to be related to cost in excess of net assets of purchased businesses reported in the financial statements of the investee companies.

Note 8. Long-Term Debt. Long-term debt at December 31, 1987 and 1986 was as follows (in millions):

	1987	*1986*
10% Subordinated Debentures, due 2004, Series A and C, $29.8 payable annually commencing in 1994 (net of unamortized discount of $73.4 in 1987 and $81.5 in 1986)	**$490.1**	$506.7
Other	**60.5**	68.4
	550.6	575.1
Current portion	**(2.7)**	(2.4)
	$547.9	$572.7

During 1987, certain of the Company's unconsolidated subsidiaries purchased Teledyne 10% Subordinated Debentures. The debentures so acquired are reflected as a reduction in the Company's long-term debt outstanding. Additionally, the Company's pension and savings plans held $85.6 million at December 31, 1987 and $45.4 million at December 31, 1986 par value of Teledyne's 10% Subordinated Debentures.

Long-term debt is payable $2.7 million in 1988, $2.8 million in 1989, $4.2 million in 1990, $5.5 million in 1991 and $8.0 million in 1992. Interest expense was $58.7 million in 1987, $73.0 million in 1986 and $89.3 million in 1985. Amounts allocated to unconsolidated subsidiaries, excluding Argonaut Group, were $42.5 million in 1987, $49.2 million in 1986 and $56.4 million in 1985. In 1987, interest expense of $10.3 million, related to a proposed Internal Revenue Service adjustment, which had been accrued in prior years, was transferred to Trinity. Discount amortization of $8.1 million in 1987, $6.2 million in 1986 and $5.8 million in 1985 is included in interest expense.

The Company has domestic credit lines with various banks totaling $125.0 million at December 31, 1987; no amounts were borrowed under these lines during 1987 or 1986. Commitments under standby letters of credit outstanding were $97.7 million at December 31, 1987. Compensating balance arrangements of an informal nature exist. Such arrangements had no material effect on the Company's consolidated financial statements at December 31, 1987.

Note 9. Shareholders' Equity. The Company is authorized to issue 60,000,000 shares of common stock, $1 par value, and 15,000,000 shares of preferred stock, $1 par value. The Company had common stock issued and outstanding of 11,667,978 shares at December 31, 1987 and 11,709,478 at December 31, 1986. No preferred shares were issued or outstanding in either year.

The Company's equity in gross unrealized gains and gross unrealized losses, before taxes, on stocks held by unconsolidated subsidiaries, excluding those investments accounted for by the equity method (Note 7), was $129.0 million and $2.0 million, respectively, at December 31, 1987. These amounts, net of the deferred income tax effect, are included in shareholders' equity.

Under various borrowing agreements, the Company has agreed to maintain minimum amounts of working capital, net worth and interest coverage, and has agreed to certain restrictions with respect to borrowing, sale of assets, purchase of capital stock and payment of dividends. At December 31, 1987, the Company was in compliance with these agreements and retained earnings of $1.5 billion were not restricted by these agreements as to payment of dividends.

Substantially all net assets of consolidated subsidiaries are unrestricted as to dividends, loans or advances. Various state insurance laws restrict the amount that insurance subsidiaries may transfer to the Company in the form of dividends, loans or advances without the prior approval of regulatory authorities. In addition, that portion of the insurance subsidiaries' net equity which results from differences between statutory insurance accounting practices and generally accepted accounting principles would not be available for cash dividends, loans or advances. At December 31, 1987, approximately $1.7 billion of the unconsolidated subsidiaries' net assets were so restricted. Additional restrictions on the payment of dividends by United and Trinity are discussed in Notes 4 and 5, respectively. Retained earnings at December 31, 1987 included $168.8 million representing undistributed earnings of investees.

Note 10. Supplemental Balance Sheet Information. Cash and marketable securities at December 31, 1987 and 1986 were as follows (in millions):

	1987	*1986*
Cash	**$ 7.0**	$ 5.6
United States Treasury notes, at amortized cost, which approximates market	**153.1**	100.7
Bankers acceptances, at amortized cost, which approximates market	**52.5**	—
Other marketable securities	**32.2**	10.5
	$244.8	$116.8

Property and equipment at December 31, 1987 and 1986 were as follows (in millions):

	1987	*1986*
Land	**$ 23.4**	$ 23.0
Buildings	**197.2**	198.4
Equipment and leasehold improvements	**682.0**	703.7
	902.6	925.1
Accumulated depreciation and amortization	**(593.9)**	(599.8)
	$308.7	$325.3

Accrued liabilities at December 31, 1987 and 1986 were as follows (in millions):

	1987	*1986*
Salaries and wages	**$ 82.6**	$ 82.0
Pensions	**4.5**	28.6
Interest, taxes and other	**171.6**	136.4
	$258.7	$247.0

Accounts payable includes $50.1 million at December 31, 1987 and $19.9 million at December 31, 1986 for checks outstanding in excess of cash balances.

Other long-term liabilities include $29.3 million and $4.3 million of advances from unconsolidated subsidiaries at December 31, 1987 and 1986, respectively, related to the purchase of Teledyne 10% Subordinated Debentures by the unconsolidated subsidiaries.

Note 11. Pension Plans and Post-Retirement Benefits. The Company sponsors defined benefit pension plans covering substantially all of its employees. Benefits are generally based on years of service and/or average final pay. The Company funds the pension plans in accordance with the requirements of the Employee Retirement Income Security Act of 1974.

Effective January 1, 1987, the Company adopted SFAS No. 87. As a result of this accounting change, pension expense (income) for 1987 was $(28.6) million compared to pension expense of $49.4 million in 1986 and $49.2 million in 1985. Pension expense for 1986 and 1985 has not been restated. The effect of the adoption of SFAS No. 87 was to increase 1987 net income by $44.7 million, or $3.83 per share.

Components of pension expense for 1987 include the following (in millions):

	Expense (Income)
Service cost—benefits earned during the year	**$ 35.5**
Interest cost on projected benefit obligation	**53.1**
Actual return on assets	**(63.5)**
Net amortization and deferral	**(55.1)**
Pension expense (income) for defined benefit plans	**(30.0)**
Other	**1.4**
Pension expense (income)	**$(28.6)**

Actuarial assumptions used to develop the components of pension expense for the year ended December 31, 1987 were as follows:

Expected long-term rate of return on assets	6.00%
Discount rate	7.25%
Rate of increase in future compensation levels	4.50%

A discount rate of 8.25 percent and a rate of increase in future compensation levels of 4.50 percent were used for the valuation of pension obligations at December 31, 1987.

Plan assets in excess of projected benefit obligations at December 31, 1987 and January 1, 1987 were as follows (in millions):

	December 31, 1987	*January 1, 1987*
Plan assets at fair value	**$1,356.2**	$1,303.4
Actuarial present value of benefit obligations:		
Vested benefit obligation	**559.5**	591.8
Non-vested benefit obligation	**35.2**	37.8
Accumulated benefit obligation	**594.7**	629.6
Additional benefits related to future compensation levels	**106.0**	127.9
Projected benefit obligation	**700.7**	757.5
Plan assets in excess of projected benefit obligation	**$ 655.5**	$ 545.9
Plan assets in excess of projected benefit obligation:		
Included in balance sheet:		
Prepaid pension cost (included in other assets)	**$ 29.7**	$ —
Accrued pension liability (Note 10)	**(4.5)**	(28.6)
Not included in balance sheet:		
Unrecognized net asset at adoption of SFAS No. 87, net of amortization	**533.5**	574.5
Unrecognized net gain due to experience different from that assumed	**96.8**	—
Plan assets in excess of projected benefit obligation	**$ 655.5**	$ 545.9

At December 31, 1987, the plans' assets, consisting primarily of fixed maturities, include debt obligations of the Company (primarily Teledyne 10% Subordinated Debentures) with a market value of $76.4 million.

The Company provides post-retirement health care and life insurance benefits to certain of its employees. The costs for these benefits, which were charged to costs and expenses as incurred, were $13.0 million, $12.6 million and $12.8 million in 1987, 1986 and 1985, respectively.

Note 12. Income Taxes. Provision for income taxes for the years ended December 31, 1987, 1986 and 1985 was as follows (in millions):

	1987	*1986*	*1985*
Current—Federal	**$106.9**	$117.5	$108.2
—State	**19.8**	18.9	24.8
—Foreign	**5.2**	4.7	5.5
	131.9	141.1	138.5
Deferred—Federal	**1.0**	(28.3)	7.8
—State	**0.8**	(2.9)	(2.0)
—Foreign	**0.2**	0.2	0.2
	2.0	(31.0)	6.0
Investment Tax Credits	**(5.5)**	(8.9)	(11.7)
	$128.4	$101.2	$132.8

Equity in net income of unconsolidated subsidiaries (Note 3) includes credits of $15.1 million in 1987, $19.0 million in 1986 and $90.2 million in 1985 representing the effect of income tax items related to unconsolidated subsidiaries. Substantially all of these income tax items were related to Federal income taxes and include deferred provisions of $3.7 million in 1987, $1.2 million in 1986 and deferred credits of $71.6 million in 1985.

Income of consolidated companies before income taxes includes income from domestic operations of $303.1 million in 1987, $220.1 million in 1986 and $303.6 million in 1985. Income before income taxes from foreign operations was $9.4 million in 1987, $10.2 million in 1986 and $11.8 million in 1985.

The effective income tax rate on pre-tax income of consolidated companies was 41.1 percent in 1987, 43.9 percent in 1986 and 42.1 percent in 1985, which differed from the statutory Federal income tax rate for the following reasons:

	1987	*1986*	*1985*
Statutory Federal income tax rate	**40.0%**	46.0%	46.0%
State and local income taxes, net of Federal income tax effect	**4.0**	3.8	3.9
Amortization of investment tax credits	**(1.8)**	(3.9)	(3.7)
Capital gain rate differential	**(0.3)**	(0.2)	(2.7)
Other, net	**(0.8)**	(1.8)	(1.4)
	41.1%	43.9%	42.1%

The Tax Reform Act of 1986 lowered the Federal income tax rate on ordinary income from 46 percent in 1986 to 40 percent in 1987. The rate will decrease to 34 percent in 1988. In addition, the tax rate on capital gains increased from 28 percent in 1986 to 34 percent in 1987.

The deferred income tax provision in 1987 includes $21.7 million related to timing differences in the recognition of pension expense. The 1986 deferred income tax credit includes deferred credits of $21.1 million related to timing differences in the recognition of pension expense and $14.9 million related to the Argonaut Group distribution. The deferred income tax provision in 1985 includes deferred investment tax credits of $7.7 million. Unamortized investment tax credits of approximately $5.3 million and $10.8 million, to be amortized principally over periods of up to three years, are included in deferred income taxes in the consolidated balance sheets at December 31, 1987 and 1986, respectively.

In December 1987, the Financial Accounting Standards Board issued Statement No. 96 (SFAS No. 96) which requires a change in accounting for income taxes. This statement must be implemented no later than 1989. The Company has not yet determined the impact of the adoption of SFAS No. 96 on the financial statements or the date or method of adoption.

Note 13. Business Segments. The Company's major business segments include aviation and electronic products, industrial products, specialty metal products and consumer products. Aviation and electronic products include aircraft engines, airframe structures, remotely-piloted vehicles, drone systems, spacecraft and avionics. This segment also includes the manufacture of semiconductors, relays, aircraft-monitoring and control systems, military electronic equipment and other related products and systems. Internal combustion engines are the major product of the industrial segment, including the manufacture of air and water cooled, gasoline and diesel fueled engines. Other products in this segment include machine tools, dies and consumable tooling. Specialty metal products include zirconium, high-speed and alloy steels, tungsten and molybdenum. Other operations in this segment include processing, casting, rolling and forging metals. The consumer segment includes oral hygiene products, shower massages, water filters, high fidelity speakers and other products and services.

The Company's unconsolidated subsidiaries (Note 3) are primarily insurance companies. One group writes life and accident and health insurance. Another group writes a broad line of insurance including liability, automobile, homeowners and commercial multi-peril, fire insurance and workers compensation. Business is done primarily in the United States.

Sales between business segments, which were not material, generally were priced at prevailing market prices. The Company's sales to the U.S. Government were $1.3 billion in 1987, $1.4 billion in 1986 and $1.3 billion in 1985, including direct sales as prime contractor and indirect sales as subcontractor. Most of these sales were in the aviation and electronics segment. The Company did not engage in material manufacturing operations in other countries. Sales by operations in the United States to customers in other countries were $254.7 million in 1987, $277.8 million in 1986 and $281.9 million in 1985.

Information on the Company's business segments for the years ended December 31, 1987, 1986 and 1985 was as follows (in millions):

	1987	*1986*	*1985*
Revenues:			
Aviation and electronics	**$1,439.3**	$1,444.3	$1,368.1
Industrial	**768.6**	819.8	930.6
Specialty metals	**713.6**	701.8	692.6
Consumer	**295.3**	275.5	264.9
Sales	**3,216.8**	3,241.4	3,256.2
Insurance and finance	**1,070.7**	1,311.4	1,460.6
Total	**$4,287.5**	$4,552.8	$4,716.8

Insurance and finance revenues include revenues of $295.1 million in 1986 and $451.7 million in 1985 of Argonaut Group.

	1987	*1986*	*1985*
Income before Income Taxes:			
Aviation and electronics	**$ 147.3**	$ 100.0	$ 117.9
Industrial	**83.3**	58.8	82.7
Specialty metals	**84.1**	83.3	78.4
Consumer	**39.4**	31.6	37.9
Total operating profit	**354.1**	273.7	316.9
Corporate expenses	**44.3**	30.4	27.8
Interest expense	**16.2**	20.5	26.0
Interest and dividend income	**(12.7)**	(7.2)	(15.6)
Gains on sales of securities	**(6.2)**	(0.3)	(36.7)
Total	**$ 312.5**	$ 230.3	$ 315.4

During 1987, the Company changed its method of accounting for pension expenses, as required by SFAS No. 87 (Note 11). Income before income taxes includes a credit of $26.8 million in 1987 compared to pension expense of $47.8 million in 1986 and $47.4 million in 1985. In 1987, income before income taxes for the aviation and electronics segment includes gains of $9.4 million on the sale of property and equipment. Income before income tax in 1986 decreased in the aviation and electronics segment primarily due to increased expenses on research and development contracts and lower margins. The industrial segment's decline in income before tax in 1986 was primarily due to the effect of depressed economic

conditions in various industrial and oil service related products. In 1985, income before income taxes for the consumer segment includes $7.2 million of gains on the sale of property and equipment.

	1987	*1986*	*1985*
Depreciation and Amortization:			
Aviation and electronics	**$ 38.5**	$ 39.2	$ 35.1
Industrial	**20.1**	29.8	35.8
Specialty metals	**25.7**	27.8	30.8
Consumer	**5.0**	4.2	3.5
Corporate	**8.0**	6.7	6.7
Total	**$ 97.3**	$ 107.7	$ 111.9
Identifiable Assets:			
Aviation and electronics	**$ 364.5**	$ 347.0	$ 337.9
Industrial	**251.5**	235.4	281.2
Specialty metals	**263.0**	245.5	248.6
Consumer	**79.2**	78.3	73.7
	958.2	906.2	941.4
Investments in unconsolidated subsidiaries (Note 3)	**1,810.5**	1,625.5	1,723.0
Corporate	**366.3**	212.5	111.0
Total	**$3,135.0**	$2,744.2	$2,775.4
Capital Expenditures:			
Aviation and electronics	**$ 29.2**	$ 42.9	$ 55.5
Industrial	**17.1**	20.8	23.9
Specialty metals	**21.3**	23.5	20.4
Consumer	**5.7**	6.8	5.3
Corporate	**8.7**	6.5	10.5
Total	**$ 82.0**	$ 100.5	$ 115.6

Note 14. Commitments and Contingencies. The Company is defending a class action brought in the Chancery Court of Delaware alleging claims relating to the Company's offer to repurchase shares of its common stock in February 1976. The action seeks compensatory and punitive damages in an indeterminate amount and alternatively, rescission. The Company believes that the allegations made in the complaint are not meritorious and that the Company has adequate legal defenses.

The Internal Revenue Service (IRS) has proposed the imposition of an accumulated earnings tax of approximately $122 million for 1981 and $128 million for 1980 in connection with the audit of the Company's consolidated Federal tax liability. The same issue may be raised by the IRS in its audits of years subsequent to 1981. The Company believes the assertion of an accumulated earnings tax by the IRS is both legally and factually without merit and intends to defend vigorously against it. In the opinion of the Company, the ultimate resolution of this issue will not materially affect its financial statements.

OUTLINE OF PRODUCTS AND ACTIVITIES

Aviation and Electronics: Products in the closely related fields of aviation and electronics range from the microscopic world of semiconductor devices to full-scale air frames and complete aircraft.

Teledyne's hybrid microcircuits are widely used in military, space, industrial and medical applications. These compact and complex electronic building blocks combine multiple transistors and integrated circuits in the smallest possible packaging size, where reliability and light weight are of paramount importance. Thousands of these microcircuits, the size of postage stamps, have been produced, and provide the precise control required for heart pacemakers and interplanetary missions, as well as many other uses.

On a still larger scale are Teledyne's high power traveling wave tubes, used to simultaneously transmit thousands of telephone conversations–or a dozen television channels–around the world via satellite networks.

Similar types of traveling wave tubes are used in the latest airborne and ground-based electronic counter measure equipment.

Other components include operational amplifiers, digital-analog converters, miniature relays, hybrid switching devices, radar augmenters, lower power microwave tubes, flexible printed-circuit interconnections, high reliability wire and cable, switches, terminals and a line of aircraft, military tank and truck batteries.

In the microwave industry, Teledyne is a leading supplier of ferrite components and switching devices, as well as filters, oscillators and integrated subsystems.

At the systems level, Teledyne produces equipment for telemetering data from remote sources, for electronic counter measures, and for information processing, as well as the aircraft integrated data systems used by dozens of major airlines to record in-flight performance and maintenance data on their jumbo jets.

Teledyne also performs systems engineering and integration for ballistic missile defense, space defense, shuttle payloads, computer software, and designs and produces military airborne training and evaluation systems.

Computing and inertial systems are also produced for the control and guidance of aircraft and space vehicles. Teledyne on-board computers have successfully controlled the launching of dozens of spacecraft, including both Viking missions to Mars.

Teledyne is heavily involved in electronic navigation systems, as well, with Loran and Omega navigators for long range sea and air navigation and Raydist systems for precise radiolocation in coastal waters. Doppler radar systems produced by Teledyne were used on 24 successful space landings and guided each Apollo lander to the surface of the moon. Similar Doppler radars are used in military aircraft for anti-submarine warfare and search-and-rescue missions.

Teledyne avionic instruments and electronic systems contribute substantially to flight safety on both military and general aviation aircraft.

The use of the latest microcircuit technology and modern cryptographic algorithms permit Teledyne to supply very advanced identification equipment (IFF) used on military and commercial aircraft for peacetime air traffic control and for safe operation in a wartime environment.

Among Teledyne's many non-electronic products for aviation are controlled explosive devices that precisely time, sequence and actuate aircraft escape systems, and similar pyrotechnic devices used to separate the stages of space vehicles, and to eject or deploy instrument packages of many kinds. Teledyne also produces parachute delivery systems for accurate air-drop of military cargo or emergency supplies.

Precise hydraulic and pneumatic actuating systems and components are made for both fixed and rotary wing aircraft, as are ground support systems such as frequency and power converters and jet engine starters for commercial and general aviation use.

Continental piston engines have been powering airplanes for sixty years, and today about half of the general aviation piston engines produced in the United States are built by Teledyne and used worldwide. Teledyne turbine engines also power remotely piloted aircraft, military trainers and, in small, expandable versions, provide power for the Harpoon and other cruise missiles. Teledyne also services and overhauls turbines manufactured by others for both military and general aviation use.

The Company's expertise in airframe manufacture goes back to Charles Lindbergh's Spirit of St. Louis which was built by Ryan Airlines, Inc., forerunner of today's Teledyne Ryan Aeronautical. More than twenty-five types of remotely piloted aircraft–usually called RPVs–have been built by Teledyne, in both supersonic and subsonic versions. These recoverable and reusable vehicles are used for sophisticated military missions with the pilots safely flying them from remote control centers. Teledyne is also building the airframe for the new Army

attack helicopter and has produced thousands of feet of tapered, roll-formed stringers used in wide-body aircraft.

Through the production of sophisticated RPVs, Teledyne has also developed broad expertise in the use of advanced materials such as graphite composites, and has facilities for the numerically-controlled machining of airfoils from honeycomb materials.

Teledyne's participation in all these diverse areas of aviation, space and electronics has given the Company highly developed expertise in some of the most advanced technologies of our time.

Industrial Products: Engines of many sorts–air and liquid cooled, gasoline and diesel fueled –are products in this category. Teledyne piston engines range in power from lightweight, portable, air-cooled engines of a few horsepower up to heavy-duty turbo-charged diesel engines approaching 1,750 horsepower for use in military tanks and heavy construction equipment.

Another category of industrial products includes machine tools, dies and consumable tooling of all types. These range from numerically-controlled pipe and tube bending machines to a great variety of machines designed for the high speed production of precision machine threads by cutting, grinding and roll-forming methods, and a variety of similar equipment for the production of precision roll-formed gears. Presses, cut-off machines and can-making machines are also produced.

Other Teledyne production equipment includes transfer and assembly machines for the automated production of many kinds of products, as well as multi-gun automated resistance welding machines, single station manual resistance welding machines, welding power supplies, arc welding equipment and consumable supplies, such as welding electrodes and tubular and solid welding wire.

Unusual among Teledyne's welding products are the world's largest welding positioners and manipulators with capacities to 450 tons. These immense Teledyne machines are used worldwide by the nuclear industry for welding and cladding nuclear reaction vessels with stainless steel.

Teledyne also produces complete automated bakery production lines and mixing and processing equipment for a variety of chemical, food and pharmaceutical products.

Closely related to the machine field are Teledyne's optical encoders and digital readouts which may be added to existing milling machines and other machine tools to modernize them, increase operator output and improve the accuracy of the work produced.

Specialized Teledyne encoders are also incorporated in many electro-mechanical devices such as robots in order to provide precise positioning information.

Teledyne also makes a variety of analytical instruments for pollution control, mine and industrial safety, petrochemical process control, and for medical and deep sea saturation diving applications.

These include percentage and parts per million oxygen detectors, hydrocarbon detectors and photometric instruments for measuring oil or phenol in water and dozens of other chemicals in the parts per million or billion range. Other related products include a variety of instruments for the physical testing of materials; meteorological instruments; equipment and services for the detection, monitoring and analysis of radioactive materials including dosimeters for monitoring the exposure levels of nuclear industry personnel; high-speed motion picture cameras; and equipment for the film recording of video images.

Computer-based control systems are provided to the petrochemical industry for controlling the flow of natural gas and oil through nationwide networks of pipelines. Electrically actuated control valves and large safety relief valves are supplied to this as well as to other industries.

Teledyne also produces a complete line of geophysical instrumentation and related computer systems that are used throughout the world in earthquake monitoring and oil exploration.

In addition, Teledyne carries out seismic surveys on land and under the sea bottom on a contract basis to locate likely oil-bearing strata for major oil companies.

Related activities include the fabrication and installation of large offshore platforms for the oil industry, as well as drilling and workover services and a variety of maintenance and salvage operations carried out in offshore areas.

The Company owns and operates sea-going derrick barges with up to 800-ton lifting capacity and numerous jack-up drilling rigs to carry on this work for the oil industry.

Sophisticated computer-designed gas lift equipment and services are also provided by the Company for increasing the flow from oil wells and controlling the flow on the surface. In addition, producing reservoirs are studied using radioisotopic tracer services provided by the Company.

Uninterruptible power supplies are pro-

duced for the computer industry to eliminate computer failures caused by substandard power or momentary power interruptions.

In the event of power failures, Teledyne emergency lighting equipment can provide safe illumination for continuing operations.

Thermoelectric generators fueled with propane or natural gas are made for use in remote, unattended locations where electrical power is required, and other Teledyne thermoelectric generators powered by radioisotopic materials provide power for deep space missions. This same Teledyne company also produces high purity electrolytic hydrogen generators that are used in many laboratory and industrial applications.

Among Teledyne's remaining miscellaneous industrial activities are the production of solid rubber urethane tires and molded products for the automotive industry.

Specialty Metals: The products of this business segment are representative of the practical application of metallurgical science and technology as it is known and practiced throughout the world. Their unique characteristics are derived from the nature of the metals produced, the particular properties of the alloys melted, and the various processes, methods, forms, shapes and end products manufactured.

In specialty metals, Teledyne is the most diversified producer of reactive and refractory metals in the United States. Teledyne produces all of the larger volume, commercially important metals and their alloys. Reactive metals production includes titanium, zirconium and hafnium; refractory metals consist of tungsten, molybdenum, columbium, tantalum and vanadium.

Teledyne is the leading U.S. producer of zirconium, a highly corrosion-resistant metal that is transparent to neutrons. It is used for fuel tubes and structural parts in nuclear power reactors, in the form of foil in photographic flash cubes, and for corrosion-resistant chemical industry applications. Hafnium, derived as a by-product of zirconium, is used for control rods in nuclear reactors due to its ability to absorb neutrons.

Teledyne is the only integrated U.S. producer of tungsten obtained from its ore mines to finished products such as tungsten powder and tungsten mill products. Previously used cemented carbide parts are also recycled into tungsten carbide powder. Wrought or ductile tungsten products are used in diverse applications including light bulb filaments, inert gas welding electrodes, electrical contacts and aircraft counter weights.

Molybdenum, a sister metal to tungsten that also has a very high melting point, is produced by Teledyne in powder form and then shaped into solid forms through powder metallurgy techniques. It is an important alloying element for steels and is used for plasma arc spraying of piston rings and for electrodes in glass melting furnaces.

Columbium, also known as niobium, is a high technology metal produced by Teledyne in various forms and alloys. Conventionally, it is used as an alloying element in the manufacture of many steels. The higher quality grades produced by Teledyne are used in superalloys for jet engines and special alloys for aerospace applications such as rocket nozzles. When alloyed with titanium, columbium is used in applications requiring superconducting characteristics for high-strength magnets. This rapidly developing field includes medical devices for body-scanning, accelerators for high-energy physics and fusion energy projects for future generation of electricity.

Tantalum, one of the most corrosion resistant metals, is produced by Teledyne for medical implants, chemical process equipment, and aerospace engine components.

Specialty metals include the special alloys that are central to the production of virtually every modern metal product available today.

Teledyne high speed steels provide the high temperature hardness required for lathe bits, drills, milling cutters, taps and dies and other cutting tools. Related alloy steels, including a cobalt-free maraging grade, are produced for bearings, gears, special aerospace hardware and high-strength applications.

For the metalworking, mining and other industries requiring machine tools with extra hardness, Teledyne produces a line of sintered tungsten carbide products, made by combining carbon, tungsten and various other metals under heat, to produce a material that approaches diamond in hardness. These cemented carbide products are used as superhard cutters in the high speed machining and cutting of steel and other applications where hardness and wear resistance are important. Technical developments related to ceramics, coatings and other disciplines are incorporated in these products.

Furthermore, Teledyne is an integrated producer of vacuum-melted nickel base, titanium base and iron base superalloys that are used worldwide to meet the high performance requirements of the aircraft, aerospace, gas tur-

bine, nuclear energy and chemical process industries. These products, in various forms, are engineered to retain exceptional strength and corrosion resistance at temperatures through 2,000 degrees F and are used in critical, high-stress applications. Notably, this manufacturing facility installed one of the largest high precision rotary forging presses in the U.S. for more efficient working of these products.

Teledyne also processes metals by a variety of methods, including casting, forging, rolling, drawing and extruding, into finished forms used in a diverse number of industries.

For example, Teledyne is a specialist in the cold rolling of thin and ultra-thin metal strip in over 60 different metals and alloys for applications ranging from watch springs and flash bulbs to aerospace honeycomb materials and camera products.

Teledyne also casts a variety of metals into forms ranging from 90-ton steel mill rolls to lightweight aluminum and magnesium aircraft parts. A variety of housings and parts are made for business machines, tools and automobiles by die casting methods. Cold-finished bar and shafting and cold-drawn stainless and custom fabricated tubing are also produced.

Other Teledyne companies are involved in roll-forming metals, forging heavy parts for construction and earth moving machinery and precision investment casting of difficult to produce parts.

Consumer: The Teledyne name is widely represented through its consumer products.

Teledyne's best known consumer products are sold under the brand name of Teledyne Water Pik. The Water Pik® oral hygiene appliance line includes a family of dental hygiene devices for use in the home, including oral irrigators, electric toothbrushes and an oral hygiene center combining both products.

Teledyne Water Pik also manufactures and markets a complete line of showerheads, including the Shower Massage® line of invigorating, pulsating showerheads and the Super Saver® line of energy saving, multi-mode spray showerheads.

The Instapure® line includes both faucet mounted and under-the-counter water filters for improving the quality of water used in the home, as well as a new line of air filtration appliances for the home and office that utilize a patented low temperature catalyst material to remove carbon monoxide and other noxious gases from the air.

Teledyne is also known throughout the world for its line of high fidelity speakers for the home and automobile and for its turntables marketed under the AR brand name.

In an entirely different consumer area are Teledyne Laars swimming pool and spa heaters. The company also produces a full line of water heating equipment that provides hot water for commercial, residential and industrial space heating.

Teledyne also makes supplies and equipment for dentists and dental laboratories. Among these are dental cements, impression compounds, filling materials, tungsten carbide and diamond drilling burs, air and electric drills, and articulators.

Teledyne produces drafting media and materials used for the creation of engineering drawings and diazo equipment required to reproduce and disseminate such information, as well as microfilm and microfiche.

Other products often sold directly to consumers include battery powered lamps, lanterns, engineering drafting supplies for professional and school use, plastic cups, containers, and wood specialty products.

Insurance & Finance: United Insurance Company of America 99.2% owned by Teledyne, writes life and accident and health insurance. Policies sold include home service, ordinary, group life, group and individual annuities, group and individual accident and health and hospitalization.

Trinity Universal Insurance Company writes a broad line of insurance covering personal and commercial risks. Coverage includes liability, automobile, homeowners and commercial multi-peril, fire insurance and workers compensation. Fireside Thrift, a consumer finance company, operates in the state of California.

Selected Quarterly Financial Data

(In millions except share and per share amounts)

Quarterly financial data for 1987 and 1986 were as follows:

	Quarter Ended			
	March 31	*June 30*	*September 30*	*December 31*
1987–				
Sales	$821.6	$781.3	$806.0	$807.9
Gross profit	$194.1	$186.0	$184.5	$191.6
Income of consolidated companies	$ 44.4	$ 38.0	$ 42.1	$ 59.6
Equity in net income of unconsolidated subsidiaries:				
Before gains on sales of investments	21.8	17.5	22.0	27.0
Gains on sales of investments	4.7	2.5	25.4	72.2
	26.5	20.0	47.4	99.2
Net income	$ 70.9	$ 58.0	$ 89.5	$158.8
Net income per share	$ 6.06	$ 4.95	$ 7.66	$13.60
Cash dividends per share	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Average shares outstanding	11,709,478	11,708,064	11,689,119	11,667,978
Common stock price				
High	$350½	$343¼	$390	$382
Low	$298¾	$299½	$334½	$242
1986–				
Sales	$805.9	$833.9	$766.8	$834.8
Gross profit	$174.4	$179.7	$175.2	$169.9
Income of consolidated companies	$ 35.1	$ 34.3	$ 35.8	$ 23.9
Equity in net income of unconsolidated subsidiaries:				
Before gains on sales of investments and Argonaut Group	22.4	8.6	25.8	18.9
Gains on sales of investments	3.0	4.4	5.4	4.2
Argonaut Group	3.3	11.0	2.2	—
	28.7	24.0	33.4	23.1
Net income	$ 63.8	$ 58.3	$ 69.2	$ 47.0
Net income per share	$ 5.45	$ 4.98	$ 5.91	$ 4.01
Cash dividends per share	$ —	$ —	$ —	$ —
Average shares outstanding	11,709,478	11,709,478	11,709,478	11,709,478
Common stock price				
High	$367¾	$358¼	$339¾	$342¾
Low	$302½	$328¼	$291	$297

Net income for 1987 includes a credit, after tax, of $4.1 million, $3.9 million, $4.0 million and $4.2 million related to pension for the quarter ended March 31, June 30, September 30 and December 31, respectively. Net income for 1986 includes pension expense, after tax, of $4.5 million, $8.3 million, $6.1 million and $6.3 million for the quarter ended March 31, June 30, September 30 and December 31, respectively.

Income of consolidated companies for the quarter ended December 31, 1987 includes $4.5 million of gains on sales of investments and $6.6 million, after tax, on the sale of property and equipment.

Argonaut Group was spun-off at September 30, 1986 as discussed in Note 3 to the consolidated financial statements.

Equity in net income of unconsolidated subsidiaries before Argonaut Group for the quarter ended June 30, 1986 includes a loss of $9.4 million representing Teledyne's equity in a net loss reported by Litton for its quarter ended April 30, 1986.

Teledyne, Inc. common stock is listed on the New York and Pacific Stock Exchanges. As of December 31, 1987, there were approximately 17,000 record holders of common stock.

Selected Financial Data

For the Five Years Ended December 31, 1987
(In millions except per share amounts)

	1987	*1986*	*1985*	*1984*	*1983*
Sales	$3,216.8	$3,241.4	$3,256.2	$3,494.3	$2,979.0
Income of consolidated companies	$ 184.1	$ 129.1	$ 182.6	$ 260.7	$ 195.0
Equity in net income of unconsolidated subsidiaries:					
Before Argonaut Group	193.1	92.7	299.6	212.5	97.4
Argonaut Group	—	16.5	64.2	101.1	12.2
	193.1	109.2	363.8	313.6	109.6
Net income	$ 377.2	$ 238.3	$ 546.4	$ 574.3	$ 304.6
Net income per share	$ 32.25	$ 20.35	$ 46.66	$ 37.69	$ 14.87
Cash dividends per share	$ 4.00	$ —	$ —	$ —	$ —
Working capital	$ 503.5	$ 333.3	$ 275.5	$ 408.4	$ 961.3
Investments in unconsolidated subsidiaries	$1,810.5	$1,625.5	$1,723.0	$1,647.1	$2,097.2
Total assets	$3,135.0	$2,744.2	$2,775.4	$2,790.7	$3,852.2
Long-term debt	$ 547.9	$ 572.7	$ 669.2	$1,070.7	$ 570.0
Shareholders' equity	$1,976.0	$1,636.6	$1,577.4	$1,159.3	$2,641.2

In 1987, the Company changed its method of accounting for pensions in accordance with SFAS No. 87, as discussed in Note 11 to the consolidated financial statements.

Management's Discussion and Analysis of Financial Condition and Results of Operations

The Company's consolidated operations consist of a large number of divisions operating in a variety of industries. For reporting purposes these operations are summarized in the segments presented in Note 13 to the consolidated financial statements. It is not practical to attempt to identify and explain fluctuations for any operating units or groups of units smaller than these segments.

Sales were relatively unchanged in 1987 and 1986 after decreasing 6.8 percent in 1985. The changes by segment are presented in Note 13 to the consolidated financial statements. Sales increased in 1987 in the consumer and specialty metals segments and decreased significantly in the industrial segment. Sales increased in 1986 in all segments except the industrial segment which decreased significantly. Sales decreased in 1985 in all segments with the major decrease occurring in the aviation and electronics segment. During 1987, the Company changed its method of accounting for pension expense, as required by Financial Accounting Standards Board Statement No. 87. Income of consolidated companies, before tax, includes a credit of $26.8 million compared to pension expense of $47.8 million in 1986 and $47.4 million in 1985. In 1987, operating profit in the aviation and electronics segment includes gains, before tax, of $9.4 million on the sale of property and equipment. Operating results in 1986 decreased in the aviation and electronics and industrial segments. The 1986 decrease in the aviation and electronics segment was primarily the result of increased expenses on research and development contracts and lower margins. The 1986 decrease in the industrial segment was primarily the result of the effect of depressed economic conditions in various industrial and oil service related products. Operating costs decreased in 1985 in line with sales. The effect of inflation did not have a material impact on net income from 1983 to 1987.

Interest expense decreased $14.3 million in 1987, $16.3 million in 1986 and $26.8 million in 1985. The portion of this interest expense allocated to unconsolidated subsidiaries decreased $10.0 million in 1987, $10.8 million in 1986 and $12.7 million in 1985. In 1987, interest expense of $10.3 million, related to a proposed Internal Revenue Service adjustment, which had been accrued in prior years in the consolidated financial statements, was transferred to Trinity Universal Insurance Company. The decreases in 1986 and 1985 were primarily due to the repayments of variable rate notes issued in 1984, discussed below. Interest and dividend income increased $5.5 million in 1987 after decreasing $8.4 million in 1986 and $47.8 million in 1985 due primarily to corresponding changes in the level of investment in marketable securities. Gains on sales of investments included in income of consolidated companies increased $3.1 million in 1987 after decreasing $24.9 million in 1986 and increasing $6.8 million in 1985.

The Company's effective Federal income tax rate decreased in 1987 due primarily to the Tax Reform Act of 1986 which lowered the Federal income tax rate on ordinary income to 40 percent in 1987 from 46 percent in 1986. The Tax Reform Act of 1986 will decrease the Federal income tax rate on ordinary income to 34 percent in 1988. Additionally, in December 1987, the Financial Accounting Standards Board issued Statement No. 96 (SFAS No. 96) which requires a change in accounting for income taxes. This statement must be implemented no later than 1989. The Company has not yet determined the impact of the adoption of SFAS No. 96 on the financial statements or the date or method of adoption.

Equity in net income of unconsolidated subsidiaries before Argonaut Group (which was spun-off September 30, 1986) increased $100.4 million after decreasing $206.9 million in 1986 and increasing $87.1 million in 1985. These changes were primarily the result of equity in gains on sales of investments ($104.8 million in 1987, $17.0 million in 1986 and $148.6 million in 1985) and the $81.7 million income effect of the Litton distribution in 1985 (as discussed in Note 3 to the consolidated financial statements). As presented in Note 5 to the consolidated financial statements, the underwriting results of Trinity Universal Insurance Company and subsidiaries improved since 1985 as a result of general economic conditions affecting the property-casualty insurance industry. As presented in Note 4 to the consolidated statements, net investment income at United Insurance Company of America decreased in 1987. The incremental effect of equity in net income of investees was $33.6 million in 1987, $16.9 million in 1986 and $30.3 million in 1985. The 1986 amount includes a loss of $9.4 million representing Teledyne's equity in a net loss reported by Litton for its quarter ended April 30, 1986. The 1985 amount includes a loss of $23.6 million representing Teledyne's equity in Curtiss-Wright's loss on its investment in Western Union. In addition, 1986 and 1985 equity in net income of investees included income of $1.0 million and $8.5 million, respectively, related to Brockway, Kidde and Reichhold which were no longer accounted for by the equity method as a result of the Argonaut Group spin-off.

During 1984, the Company acquired 8,661,053 shares of its common stock. This purchase of stock was financed through bank loans of $800.0 million and through internally generated funds, which were obtained from sales of marketable securities by consolidated companies and from repayments of advances and return of amounts invested in unconsolidated subsidiaries. These notes were repaid as follows: $97.5 million in 1986, $402.5 million in 1985 and $300.0 million in 1984.

Shareholders' equity increased $339.4 million in 1987. The change was due primarily to net income of $377.2 million, an increase in net unrealized appreciation of $19.0 million and cash dividends of $46.8 million. In 1986, shareholders' equity increased $59.2 million due primarily to net income of $238.3 million, the distribution of Argonaut Group of $217.2 million and an increase in equity in net unrealized appreciation of $37.0 million. Shareholders' equity increased $418.1 million in 1985 due primarily to net income of $546.4 million and a decrease in equity in net unrealized appreciation of $129.4 million. Assets decreased $1.06 billion and shareholders' equity decreased $1.48 billion in 1984 primarily as a result of the acquisition of Teledyne stock discussed above.

The Company has been able to meet all cash requirements during the past five years with cash generated from operations. Restrictions on the net assets of subsidiaries as to dividends, loans or advances, discussed in Note 9 to the consolidated financial statements, have no impact on the ability of the Company to meet its cash obligations. The Company is not aware of any impending cash requirements or capital commitments which could not be met through internally generated funds.

Working capital increased $170.2 million in 1987 and $57.8 million in 1986 after decreasing $132.9 million in 1985 and $552.9 million in 1984. The current ratio was 2.12 to 1 in 1987, 1.80 to 1 in 1986, 1.68 to 1 in 1985 and 2.12 to 1 in 1984. The changes in 1987 and 1986 were primarily the result of investing cash generated from operations and dividends from unconsolidated subsidiaries in marketable securities and other current assets. The changes in 1985 were primarily the result of the repayment of long-term debt discussed above. The changes in 1984 were primarily the result of the repurchase of stock discussed above. The Company is not aware of any circumstances which would adversely affect its liquidity or capital resources in the near future.

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55 Hawthorne Street
San Francisco, California 94105

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This **Teledyne Report** describes two new robot aircraft, known as UAVs, or Unmanned Air Vehicles, that Teledyne Ryan Aeronautical is presently introducing. The company has an unmatched record of experience in the field of unmanned air vehicles designed for a variety of purposes ranging from training targets to reconnaissance and surveillance vehicles. It is in this latter category that the new Model 324 jet-powered photoreconnaissance vehicle, and the new Model 410 long range, long endurance reconnaissance/surveillance vehicle belong. These vehicles address both the military need for gathering intelligence information at low cost and without risk of human life, and non-military needs for long-term surveillance of coastlines and borders to intercept illegal immigration, smuggling and drug running, terrorist activities. Other commercial applications are discussed as well.

Teledyne Report features subjects of particular interest from Teledyne activities, and is issued on a quarterly basis. Previous topics include:

Composites:
Ultra-light structures for aircraft.

Integrated Circuits:
Bridging the analog and digital worlds.

Microelectronic Hybrids:
State of the art 1987.

Voyager Engine:
Around the world nonstop in 9 days.

Forming Metal:
Lightweight structures for aircraft.

Radon:
Measuring it from the ground up.

IFF:
Electronic passwords for aircraft.

Star Wares:
Products & services for space.

The Water Products:
For health and personal care.

An Ideal Package:
A look at collapsible metal tubes.

Airline Communications:
The digital connection.

High Performance Metals:
Tough alloys for tough environments.

Airframes:
Structures for aircraft.

The Ladle and the Hammer:
Casting and forging iron and steel.

High Tech Wire:
Taking the heat safely.

Electronic Counter Measures:
Protecting friendly forces.

Rubber & Metal:
Working together in automobiles.

Stress Analysis:
How much is enough?

Drafting:
Designs to build by.

Systems Engineering:
Creating complex systems.

Flexible Printed Circuits:
The space age connection.

Mixing:
A fine blend of art and science.

Aircraft Ground Support:
Saving the airlines millions.

Turbine Engines:
Smaller in size and cost.

Heating Water:
For health and home.

Relays:
Thriving in an ultraminiature world.

Truth In Radiation:
A matter of accurate measurement.

Remotely Piloted Vehicles:
Those ingenious flying machines.

Mining Tungsten:
From glowing ore to versatile metal.

Hi-Fi:
Music reproduction goes hi-tech.

Columbium:
From superconductivity to computers.

Energy:
Fueling spaceship earth.

Radar:
Sensing the unseeable.

Fluid Power:
Muscle for machines.

Pipeline Controls:
Operating petroleum pipelines.

The Aerospace Metals:
Superalloys and titanium.

Screw Threading:
Machine tools for industry.

Aerial Mapping:
Advanced digital techniques.

The Water Pik Story:
Innovative consumer product designs.

Dental Health:
Supplies for the dentist.

Space Navigation:
Computers that guide space launches.

Analytical Instruments:
Chemical detection for industry.

1776-1976:
Technology then and now.

Life Insurance:
Financial security and investment.

The Refractory Twins:
Producing tungsten and molybdenum.

The Instrument Makers:
Instruments and optical encoders.

Industrial Engines:
Small piston engines.

Job Corps:
Teaching young people new skills.

Friendly Explosives:
Aircraft emergency escape systems.

Microelectronic Hybrids:
The step beyond integrated circuits.

The Energy Options:
Nuclear fuel versus coal.

Workman's Compensation:
Extending the coverage.

Drilling for Offshore Oil:
Getting the oil out.

The Search for Oil:
Finding new oil deposits.

High Speed Steels:
Premium alloys for machine tools.

Energy Crisis in the Computer Room:
Controlling power quality.

Raydist:
Super-precise radiolocation system.

Welding:
Advanced alloys for joining metals.

General Aviation Engines:
Piston power for aircraft.

Rubber:
Products for automobiles and industry.

Loran:
All-weather navigation system.

Seismology:
Instruments for earthquakes.

Casting:
Precision production of metal parts.

Aircraft Integrated Data Systems:
Monitoring commercial aircraft.

Thermoelectrics:
Conversion of heat to electricity.

Thin Metals:
How they are made and used.

The Reproduction of Music:
Speakers for high fidelity sound.

The Crowded Spectrum:
Technology of traveling wave tubes.

Science and Cinematography:
Motion pictures for scientific analysis.

TELEDYNE, INC.