1927-1941: THE YEARS OF FAITH

After the others had gone home, he sat down to his diary.

"Hellish day," he wrote. *"Marston disturbed as to whether I should try to borrow money from family. Downtown to bank to see Belcher. Told him situation and that I couldn't put in any more money without cooperation from others. Asked him to give us a thought as to ways out. I feel groggy and stale."*

Every bone in his body was weary. His neck, which had been bothering him, was growing steadily worse; the hip was so painful that it was torture to walk through the shop. He didn't have to very often. There were fewer and fewer people there.

"Paid off the men with personal check for $340," he resumed, *and ate at the Diner. Don't see how I can go on."*

But the writing, the handwriting moving deliberately line by line across the page, was firm and clear, small, full of character—and between the lines, a desperate faith.

Two days later he moved his family to cheaper quarters.

The time was March 25, 1930, and the man who was to head a $50-million-a-year business was not sure he could meet the water bill of his tottering corporation. And certainly not the rent. Within a month the working force would be down to six. Seated in his office (he was seldom there; it was back and forth, back and forth to Los Angeles trying to sell Solar's MS-1) Edmund Price faced the depression with a company barely solvent.

The sales (when the year ended) were to amount to barely $8,800; the working capital was less than that. Net worth of the company—its capital and surplus—was carried at $184,150, and it was to drop far lower in the years to follow. There was $25,000 worth of plant and equipment, every inch of it mired in debt.

To keep it all going, there was a note of $20,000 endorsed by six people which had to be renewed month by month with begging, pleading and wrangling, even with his own directors. He had poured his own money into the faltering venture, borrowed from his relatives, pledged his very life insurance. His assets were a single plane—the Solar-built MS-1, an all-metal sesquiplane—and a grim determination that none of his friends in the eastern financial world he had left behind him would point the finger of failure at him. Above that he had no market—but a curious knack of instilling faith in those who worked with him . . . and stuck with him through the unending black days that lay ahead.

The story of Solar Aircraft Company as it stands on the threshold of its second quarter century is inextricably linked with that of its founder, Edmund T. Price.

To young Ned Price at 33, the beginning of it was rosy enough. Upon graduating from Haverford College he'd served in the Army during World War I, then went into the investment business, and after nine years with three eastern firms he resigned as a vice president of W. R. Reynolds & Company in Jackson, Michigan. "In every job I have had," he told his friend Murray Quigg, a New York attorney, "I seem to find myself trading against somebody instead of with somebody. I am going to the West Coast and find a business in which I can invest both myself and my money, and have reason to hope that both will grow and come to mean something worthwhile."

He found San Diego in August 1928 pretty much as he'd remembered it 13 years before, when his family had driven cross-country from their home in New Bedford, Massachusetts, to take in the 1915 Panama-California Exposition. The bay was still as blue, still as beautiful; the California Tower, tallest of the Exposition buildings, still rose above the stately eucalyptus trees in Balboa Park overlooking the city, glinting in the sunlight. He'd promised himself, back in 1915, watching some small planes winging overhead in a demonstration flight, that someday he'd join this new growing industry—and someday return to San Diego to live.

Now, following the surge of excitement aroused by young Charles Lindbergh's famous flight in a plane built in San Diego, the city had reason to hope it might well become "The Air Capital of the West." The new airport, Lindbergh Field, was being completed, and two small aircraft firms had set up shop in an empty fish cannery building

SAN DIEGO'S WATERFRONT—1924. In 1927 two firms set up shop in an empty fish cannery buiding at the foot of Juniper—the B. F. Mahoney Aircraft Corp. and the Prudden-San Diego Airplane Co., Solar's predecessor company. (From Union Title Insurance & Trust Co. Historical Collection)

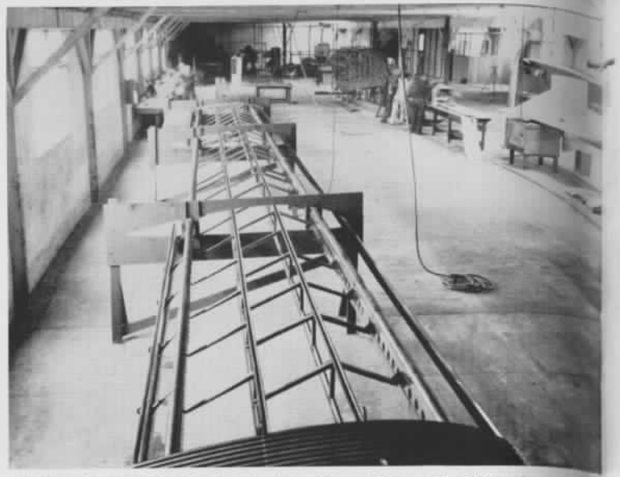
near the field—one, the B. F. Mahoney Aircraft Corporation, which had built the "Spirit of St. Louis" early in 1927 and was turning out a plane a day; the other, the Prudden-San Diego Airplane Company whose first plane, the XM-1, a 3-motored all-metal job, was test flown in the fall of 1927. The Navy, too, had based an air station on North Island, across the bay next to the Army's Rockwell Field, and had contributed toward the financing of Lindbergh Field. Times were prosperous, and to young Ned Price the future looked good.

He settled his wife and three children in temporary quarters in Ocean Beach and, two days after his arrival, he met George Stone, an attorney, told him of his ambitions, and asked about the Prudden outfit. Stone introduced him to Bruce Starke, the firm's newly elected president. Starke, though interested, told him frankly that no executive positions were available—they needed only technically trained people—and suggested he see George Prudden, the managing director. So Price went down to the plant, talked with Harry Taylor, the secretary, and chief engineer Bill Lewis. "Both told me much of future possibilities," he wrote in his diary that night. "Looks as if we would stay in San Diego."

Two days later, on Labor Day, he went to see Prudden at his home. After a two-hour confab, Price agreed to go to work—at no salary, for a while—with the promise of a directorship if he'd buy some stock. Next day he dropped by the plant and went out to the field to see the Prudden-designed XM-1. "She was a creature of sharp angles," he recalls, "that took off at 80, cruised at 80 and landed at 80—and literally took my breath away when I made my first flight." Meanwhile, the firm's second plane, another 3-motored ship designated the TM-1, was being re-designed and eventually emerged as the SE-1, powered by a single 400 hp Pratt & Whitney Wasp engine.

LINDBERGH'S "SPIRIT OF ST. LOUIS," built by the B. F. Mahoney firm early in 1927, emerged in sections from converted fish cannery's 2nd floor. (Photos taken by Fred Rohr, then Mahoney's sheet metal foreman—now president, Rohr Aircraft Corp.)

THE PRUDDEN XM-1, designed by George Prudden, right, now Director of Quality Control at Lockheed, was test-flown in 1927. Of Solar he said recently, "Everything that Solar Aircraft Company has become is due entirely to the hard work and faith of Edmund Price. He deserves all of the credit. He took over the firm when it looked as though it couldn't withstand failure any longer, and he stayed with it through the depression and made it a success . . ."



INVESTORS WERE DOUBTFUL: Prudden Aircraft Corp's. 50 x 200 ft. shop in 192[illegible]

WEIGHING IN: Solar's first plane, the all-metal MS-1 designed by Bill Lewis, was underway by mid-1929 and was completed, despite the depression, in January 1930.

PRUDDEN'S SECOND PLANE, the SE-1, originally a tri-motored ship designated the TM-1, completed in 1928, survived stress and strain of various publicity stunts; eventually earned a down payment from the Mexican government.

AIR MEETS were frequent in the late 20s. San Diegans, boosting their city as the "Air Capital of the West," turned out to see the take-offs at the National Air Races in 1928, held on the mud flats north of Barnett Ave.—looking west from the site of today's crowded Navy and Frontier housing section. (From Union Title Insurance & Trust Company Historical Collection)

On October 10, a little over a month after his arrival in San Diego, Price was made managing director—still at no salary—of the company, which had now re-incorporated under the laws of Delaware and had changed its name to Prudden Aircraft Corporation.

The Prudden-San Diego Airplane Company was originally a syndicate of San Diego businessmen formed early in 1927 with a $60,000 capitalization, and incorporated under the laws of California in November 1927. Its original directors were Charles O. Richards, president; B. W. Sinclair, vice president; Bruce B. Starke, treasurer; Herbert S. Richards, secretary, Phillip F. Bartlett, Bradley Tyrrell, Ed Fletcher, and George H. Prudden, managing director. Prudden had come to San Diego in 1926 after working with Bill Stout in Detroit to develop the well-known Ford Tri-Motor, and was instrumental in pushing the plans and financing for San Diego's present-day well designed, centrally located airport. He resigned shortly after to join a firm in Georgia, and after an eventful career is today still important to Solar as Director of Quality Control of one of its best customers, Lockheed Aircraft Corporation.

The next Sunday, Price took his children to see a parachute jump, and that evening they heard Sousa's band. It had been a busy two months, those first months in San Diego—but he'd found himself a business. His job? Sell the two Prudden planes and get the firm in the black. It had been suggested that the XM-1 might be sold to a movie company for crash scenes, and he'd been instructed to check Department of Commerce airworthiness requirements so the SE-1 could be sold to an airline. Talking with Bill Lewis, Price suggested they might, in the meantime, make some toy helicopters to reduce overhead. (You had to reduce *something* with a company $300,000 in debt.) "Only a person of Price's tenacity," remarked Lewis 24 years later, "would have picked up this dead cat. He took discouragement as a challenge and could have found 1000 reasons for closing up in those days."

Lewis, meanwhile, was busy working on the design of a third plane. He'd joined the Prudden Company in October 1927 with eight years of experience in military aircraft design at Chance-Vought and Boeing, and knew exactly what he was doing. The SE-1, he knew, was overweight. They'd never get certification on it. Better start from scratch and build a *real* ship. Joe Seamons, who'd joined the company in March 1928 as assistant chief engineer, was also from Boeing, and was helping Lewis on the new plane. Fred Rohr, shop superintendent, who'd also joined the company in March, knew what he was doing, too. He'd worked as shop foreman in the Mahoney outfit next door, was an expert sheet metal craftsman, and had an idea you could stamp out plane parts by drophammer. (Rohr's drophammer, first at Solar, first in the industry, was classic: he and Lewis had rigged it up mostly of scrap materials—its bed was about two feet square. Reaching for the nearest handy pattern—it happened to be a toilet seat—Rohr pressed it into a box of moist plaster, made a sand mold to cast a set of zinc and lead dies, and stamped out 20 aluminum seats so fast the directors were convinced his idea was practical.) Their mechanic and timekeeper was Red Perry—and that just about made up Price's working force.

The "plant," as one early visitor recalled, was more like a neighborhood sheet metal shop—a 50 by 200 ft. one-story wing angling off the two-story building on Belt St. occupied by the Mahoney Company, flanked on either side by fish canneries. Nearby was the Van Biezel Engine Company, and more canneries. The planes were assembled out on Juniper Street's dead end. (Driving to work, you coasted down from Kettner, bumped over Belt Street's ruts and pulled up right along the side of the building.)

The Mahoney Company moved out in December 1928 to set up shop in St. Louis. (Four of its crew—Gene Smith, Jack Thrasher, Charlie Herms and Al Heisel—later hired on at Solar and are still with the company.) Don Hall, who designed Lindbergh's plane and still works in the business for the Navy at North Island, remained upstairs doing consulting work, working at his drafting board late into the night as the empty building echoed with the scurrying of an occasional rabbit-sized rat.

That left one aircraft company in San Diego, re-named "Solar Aircraft Company" in April 1929. (The name was suggested by Eric de Wolfe, a director of the company, who pointed out that it would be useful for deriving future airplane names such as the "Mars" and "Jupiter" as Solar stretched its wings.) The directors gave Price their vote of confidence for his splendid work (they'd elected him vice president in January), and elected Coburn S. Marston a director—a man who, time and again, was to give young Ned the encouragement and counsel he needed so desperately in the black depression years ahead. That month, too, a serious, dark-eyed young man from Coffeyville, Kansas, took the job of bookkeeper at $25 a week. Al Briggs—today treasurer of the company and second oldest in service—has wondered hundreds of times why they hired a bookkeeper with so few funds to keep track of, and how they ever made the payroll from one week to the next in those early years.

How Solar and its little crew held together through the next five years is an unbelievable story of a never-ending seemingly hopeless week-by-week struggle in the face of day-to-day defeat. Even so a few of its employees showed their faith in the firm by purchasing stock on a deferred payment plan, and work on Solar's third plane—the MS-1—was started in May. Lewis's design—it was to be an 8-place all-metal job powered by a 425 hp Wasp engine—had been checked by Professor Reid at Stanford and was considered sound. (The SE-1 had finally earned a $1000 down payment from a purchaser, the Mexican Army—but when the pilots arrived in Arizona to pick it up, they refused to fly it because of its large size. It was eventually moved to a Los Angeles airport, lay there unclaimed for months, and was finally auctioned off to recover part of the rental due and scrapped.) Fred Rohr started stamping out duralumin sections for the MS-1 on the drophammer, and despite the shattering effect of the stock market's tailspin in October, the plane was completed in January 1930.

1929 had been a long, hard year. 1930 was to be even worse. "To the plant and up-town to put $500 in for payroll. Last help I can give . . . Made up my mind to resign and go out and earn some real money. Been here too long and almost broke," wrote Price in his diary on January 4. But four days later he was quoting the MS-1's price and delivery date to Admiral Too of the Chinese Navy, who'd arrived at the plant with 30 aides in tow. (Harry Taylor was out getting a weighing scale and permit to set the plane up in the street, and the new Solar triangle, still in use today, was painted on its side.) That afternoon Price went up-town again to try and arrange additional financing. His most encouraging response was the comment, "San Diego does not deserve to have such a good plane or company." Back at the plant, he offered his resignation at the directors' meeting—not accepted.

SOLAR'S FIRST: Capt. Charles Lindbergh, right, praised MS-1's performance shortly after its test flight in January 1930. With him, left, Fred Rohr and, in cabin, MS-1's designer Bill Lewis.

KEY TO THE FUTURE: Mechanic Red Perry took time off to pose with Solar's—and the industry's—first drophammer-formed manifold. Built of mild steel, it was mounted on the MS-1 after its first flight to replace original outside-purchased bent tubing ring.

"January 21, 1930: Plane moved onto Lindbergh Field. Much excitement. Taxied to the hangar and found brakes needed strengthening. Delay. Doug Kelley taxied for a few moments, took off, sailed half an hour and made a most beautiful landing. Great relief—ship a success."

The MS-1's successful flight undoubtedly marked a turning point for Solar—not because it could be readily sold (the depression had pretty well snuffed out any demand for planes), but because, marked with Solar's flying sun, it symbolized for Price the first forward step in creating something worthwhile. "It was good to look at," he recalls. Its construction was sound, rugged and clean; Lewis's design had given it unusual stability. Flying it with Kelly a few days later, Colonel Lindbergh praised its performance highly. When the directors met on January 27, Ned Price, despite criticism and dissension among the 40 stockholders, accepted the responsibility of heading the firm. He was now president of Solar Aircraft Company. Coburn Marston was elected vice president and general manager, and Bruce Starke continued as chairman of the compromise board.

Not so good to look at was the balance sheet. They were deep in debt, and Price spent most of his waking and some of his sleeping hours desperately trying to line up ways and means of getting more working capital and selling the MS-1. Day after day, month after month, he called on San Diego businessmen, Los Angeles businessmen, Paul Hoffman at Studebaker—hundreds of men on the West Coast and in the east—not interested. Scrounging up six endorsers, he finally got the $20,000 note renewed for 90 days, decided the 20-man working force must be cut. Three men were laid off in February, six more in March.

Pants pressed and shoes shined, he went to the bank again. Should they recapitalize? Go into receivership? Though he couldn't afford it, he put $50 into the account for the payroll. His good friend George Stone vigorously squashed the idea of receivership—but back at the plant he encountered more tension as the word got around that he intended to curtail. The city tax collector came; Price told him to come back later and resumed work on some articles for "Aero Digest" and "Western Flying." When he got home, he found the Scottie had been run over. His daughter Joan had a bad cough, and the kitchen ceiling fell in during a storm that weekend. (He'd told the landlady they were moving to cheaper quarters, and turned down her offer of a job running a garage at $100 a month.) By the end of April there were just six on the payroll. (Price was not one of them. He didn't draw his first salary check until 1934.)

Out on the field the MS-1 waited. In its exhaust ring, had Price and his six-man crew realized it, was locked the key to Solar's future. They'd originally mounted a bent tubing manifold bought out of Detroit on the engine to carry off the exhaust gases, but it had failed because of high back pressure. Fred Rohr—and the drophammer—had again solved the problem after the MS-1's first flight by stamping out a mild steel collector ring made in half sections, tapered in cross-section to allow for gas expansion—and the new design (Price had suggested they try it back in December) did the trick. In the meantime, he followed every possible lead to make the MS-1 pay her way until a buyer could be found. Maybe she could haul seafood from Baja California. He went up to Fresno to see if he could interest someone in using her to haul raisins. (The mayor said he thought he could raise $150,000 if they'd move the company to Fresno.) Bill Lewis resigned in June. Price had 30 days left to pay Solar's current and back rent; took $25 out of the household account to make up the payroll.

While attending an air meet in Alhambra in May, he'd fallen into a discussion about manifold corrosion problems with a Crucible Steel representative who'd asked why they couldn't be made of stainless steel. Price said he could think of no reason why not, and asked for some samples for trial purposes. The weeks went by. He rushed up to Downey to pick up a check for $114 on two exhaust stacks, and the extra stock of duralumin was sold to pick up a few more dollars. A Navy Lieutenant called, expressing interest in the MS-1. (When Price learned he might have to pay $2800 more on his 1928 income tax, he charged into the shop, personally riveted on a stabilizer, made a mold and some dies, and pounded the drophammer to let off steam.) The MS-1's certification finally came through in July, and in August he drove up to Crucible to pick up the stainless samples. In September he learned of a $1,000,000 potential pursuit plane order the Mexican government was considering, called on Lt. Cdr. Stevens at North Island to find out about pursuit ship data, got chief engineer Joe Seamons working on designs, saw Stevens again about the possibility of making some trial exhaust stacks of stainless steel, and, in October, took the train to Mexico City. (After three weeks of interminable delays, he returned with a fake diamond and letters indicating the Mexican government's interest in buying Solar ships. Not good enough, said the bank, for a loan.) Back at the plant, a report came in on a Navy exhaust stack contract, and they learned that an excellent letter of recommendation had been sent to the Bureau of Aeronautics on Solar stacks. The Bureau followed late in November with an order for two stainless steel stacks, contracted as an experimental order, for $250 apiece.

SOLAR'S MS-1, an 8-place all metal ship, did a number of jobs on lease to pay its way until 1932 when it was sold to the Cia. Aeronautica del Sur to haul coffee and passengers from the interior of Tabasco, Mexico, to the coast.

From that casual and coincidental 7-month chain of events, hinging on a request for some stainless samples and North Island's interest in a new idea, grew a new and challenging business for Solar—though at the time the order was regarded just as fill-in work to keep the crew busy until they could work on planes. They ordered an old Wasp engine from North Island to use for a jig, and a sheet of 18 gauge stainless, another of 11 gauge for flanges. Plant manager Fred Rohr and the boys had their troubles on the welding and pickling—no one knew much about working with this new metal—but they eventually got the two manifolds fitted and tested in service. (One went on a Chance-Vought 02U-4 observation biplane, the other on a Boeing F4B-1 fighter.) After the Navy job was finished, they made a new manifold for the MS-1 out of stainless. "Can make out balance of year if we get $500 from Navy on the stacks," wrote Price in December. By borrowing against the Navy order he got enough here and there to make the payroll for the last week of 1930, with $10 to each man on back pay for Christwas, and on Christmas Day he made a gate for the back yard despite an invasion of ten children—no fights.

Price was still digging into his personal account to meet the payrolls as Annual Report time rolled around again in 1931. The money went out faster than it came in. He got a premium loan on his $5000 insurance policy. The directors were interested in the firm's small progress, wanted to keep the plant open, but couldn't suggest how. The following month, February, he managed to raise a loan for the first week's payroll on the strength of another order for manifolds from North Island—one for a Ford plane, two for a Loening amphibian. (Solar was backing its manifolds with a year's guarantee, except for salt water corrosion; the Boeing and Chance-Vought installations were still in service after 18 months.) He cancelled out another insurance policy in April, considered leasing out the MS-1 for spotting gold caches in Baja California (someone had also wanted to lease it for hunting sheep), sent the shop a $25 order for one Curtiss manifold ordered by the Ryan Aeronautical Company —again in business after four years—and, after sweeping out the office, went to see a patent attorney about an improvement on an exhaust stack he'd figured out at 2:00 one morning. (He still keeps a pad handy by his bedside, still reaches for new ideas, new ways of designing or building or marketing a new product.)

"April 24, 1931: Advised boys no pay tomorrow. Upset. Hip bothered." Something had to be done soon, he knew. He deposited some shares of Westinghouse to make the payroll, and five days later drove up to Northrop to quote on two manifolds. It was his first attempt to sell to an airplane company directly.

He deposited his veteran's check to cover the May 1 payroll, but couldn't make it the following week. Chance-Vought was interested in quotes on a manifold, was considering ordering 20 a month—but things were not good. "Definite close down—or go ahead," he told himself, and told the directors he could carry operations no further alone. They agreed to chip in to help carry the company for another four months, and he deposited more Westinghouse shares.

By the end of the month Northrop had approved the manifold designs and ordered five more, the Navy had ordered 72 struts—and the bank renewed the $20,000 note. The crew was down to four or five men. (They held mudball target practices on the back door, lunchtimes. It helped, somehow, to steady the nerves and squash the jitters. It

FIRST stainless manifolds went on a Chance-Vought 02U-4, left, and a Boeing F4B-1 in 1930, followed by stacks for a Ford tri-motor, center, and Loening amphibian, right

FLYING NURSERY: Price's flight east with his family in the MS-1 in 1931 drew publicity—but no orders. Charles, Joan, and Mitzi played parcheesi in the specially fitted cabin.

wasn't easy, keeping the family in groceries on 35c an hour, wondering every week whether there'd be any pay at all.) Price and Rohr lashed the Northrop manifold on the back of the car, drove up to L.A. to get it sandblasted, delivered it and picked up the check. A week later he drove up again with another manifold, got another check. Northrop had ordered six sets of heaters—but there was no pay for the crew the following week. In July, his father died.

Price decided to fly his family back to New Bedford in the MS-1 as a sales promotion stunt, and the "Flying Nursery" received national publicity, landing at 50 airports in 25 states en route. Though Northwest Airlines had tentatively ordered ten planes, the order was cancelled when the man who'd negotiated it died suddenly of a heart attack. Price almost had one, too, and quietly decided to abandon the idea of manufacturing airplanes.

He was back at the plant in September, slugging out the interminable balancing of week-by-week orders to make payrolls. (Total debts were five times total assets.) They'd beat out a competitor on a Navy bid for a $11,920 F4B-1 gas tank repair job in October, though, and had a contract for 12 demountable exhaust rings. Jack Northrop closed up that month, and Price bought one of his file cabinets. North Island reported trouble on a test stand stack; Lon Wheeler checked and found they'd installed it upside down. In November, Price was down at the bank again to arrange a new note renewal, and received assurance that the company wouldn't be closed down. On month later, Solar was awarded a $2,960 contract from Boeing on heaters and stacks, and the bank extended $3000 credit in the nick of time.

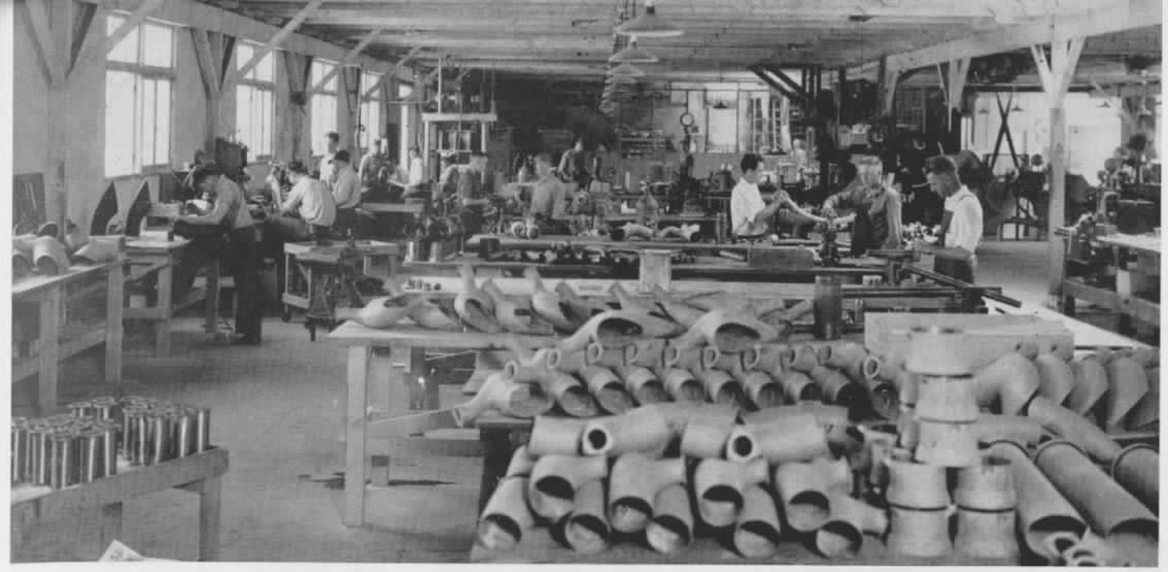
Things were to rock along that way for the next four years, more or less—up and down, up and down. Price didn't keep a diary in 1932. He didn't think the effort would be worthwhile. But his was the deciding vote that kept Solar in business when the directors deadlocked on a motion to stay open or close up shop—and the crew soon found themselves beating out outsize baking pans for the Naval Training Station, square aluminum bacon frying pans, polished stainless bookends to keep busy between manifolds. Some outlook! The MS-1 was finally sold to the Compania Aeronautica del Sur in April for $10,000. Though the sturdy plane did its job very well for many months, hauling coffee beans from the interior of the state of Tabasco, Mexico, to the coast, it was one day forced down in the jungle with engine trouble. During its take-off from a hurriedly cleared runway, its landing gear hit a log which crumpled a wing—and it died. The airline also died eventually, in 1936, and the $9000 balance due on the MS-1 was written off as a bad debt.

Though it was extremely difficult to obtain credit, the struggling company somehow kept its footing, helped immeasurably by a $25,000 credit on stainless steel purchases extended by Charles Ducommun of the Ducommun Metals Corporation in Los Angeles. The 27 men in the shop extended credit, too—six weeks' worth. The Navy had specified Solar manifolds on Chance-Vought and Boeing ships, and a $25,000 Boeing order had come through in April for 120 manifolds for its new 180 mph 247 transport. Unfortunately, reported Al Briggs, the bottom of the barrel had been scraped for cash; there just wasn't or wouldn't be enough to meet the payroll until they received payment from Boeing.

Price laid the facts on the table in the shop. It was a tense situation, but he spoke quietly, firmly, enlisting their help on what was to be their first major job. "Hell," bellowed Bill James, the drophammer operator, "let's get to work!" And the boys in the shop and the office tightened their belts, bummed a quarter here, a dollar there from each other to keep their families in food—and completed the order. When Boeing's check came in, they were paid in full, plus 6% interest on their loan.

It was a loan in faith as well as in time and labor—and gave Price, many times over, the support he needed to pull his company through the rough weeks—and months—and years ahead. Solar was in the manifold business for sure, now, and that summer he drove east, following every possible lead to get more orders. The crew, now 32, was still working at the end of the year.

THE CONTRACT that saved a company. Part of Solar's first major order, $4000 of manifolds, stacks and heat exchangers for the Boeing 247, which literally rescued our payless, debt-saddled little plant in 1932, gave us a foothold.



THIS WAS SOLAR—all of it, in 1934. We had one big drophammer, little money, but lots of courage. Joe Greene and Axie Sprenger are at the welding bench, left, Dale Harman in the left background, and Earl Foster is at the jig. Paul Birbeck's there, too.

Though the figures at January 1933's annual meeting showed an $1800 gross profit, they also showed a loss, after taxes and interest, of $1900. Solar lost a valuable man that month, too. Fred Rohr, now president of Rohr Aircraft Corporation—a $40,000,000-a-year firm he started in Chula Vista, south of San Diego, in 1940—left to go to work at Boeing. However, Price could report that Solar was planning to rent more space in the two-story building facing Belt St., that they'd bought a heat treating furnace for $380 with six months to pay, and that they had orders for five manifolds from Douglas, five from United Airlines, and 59 tailpipe outlets from Boeing.

When the directors met again in April things looked a little better, but not much. They'd shipped over $10,000 worth of goods in March and had made a net profit of $3000, but three times he'd had to pay the 10-man crew $5 emergency checks, waiting for payment on orders. They needed some quick-pay work and were investigating the possibility of making collapsible tubes for the West Coast market, stainless steel cooking utensils, stainless bodies for the Gas Company's trucks. Joe Seamons was working on a design for stainless steel beer barrels—and someone had suggested making quart-sized stainless pocket flasks. Price's sales trip was paying off, though. More orders were coming in from the Navy, Boeing, Douglas, Pratt & Whitney, Chance-Vought, K.L.M., Northrop—and they'd ordered 67 sheets of stainless from Ducommun. Solar's landlord, Dr. Harry Wegeforth, had offered to sell Buildings 1 and 2 and cancel the back rent, and in May Price raised enough money to buy an option on the leasehold; then got the Harbor Department to buy Building 2 in exchange for Solar's option, a reduction in rent, and cancellation of back rent. (Not for nothing was he descended from a long line of New England sea traders!)

By mid-June, Price could give the directors an excellent financial report—bills were nearly current. Al Briggs, cruising along slightly behind Price with four years of service, was appointed assistant treasurer. Solar's president then took a deep breath and set out on an 11-week sales trip,

BETWEEN MANIFOLDS, the crew turned out stainless cases for water trucks, bodies for the Gas Company's electric trucks.

driving 9263 miles to make almost 50 key calls on airlines, aircraft firms, steel manufacturers and fabricators from Cheyenne to Pittsburgh and government offices in Washington and Dayton. (His expense account: $427.82)

When he returned, the books showed over $20,000 in unfilled orders. His slugging—and the crew's—since that crucial Boeing order back in April '32 was paying off. Even with a $9000 profit after charges, though, he was still having trouble making payrolls, waiting for checks to come in, assigning some orders to steel suppliers to pay for material. The plant went on two shifts in November to fill rush orders, and though he'd learned from the Navy that competition was coming into the manifold business, it looked like Solar was over the hump—maybe. He urged stockholders to hang on, hoped the directors would back him up a little longer, and got the $20,000 note renewed—without endorsers, this time.

There was plenty of work on hand in 1934, but there was always a lag between incoming checks and materials and ready cash to meet payrolls for the small crew. Walter Clark, the new plant superintendent, was running ragged to make delivery dates. "Everything seems very futile," wrote Price. "Production still not fast enough . . . Need more working capital." New financing seemed to be the only answer,

THIS WAS SOLAR—AND DROPHAMMER 2—IN AUGUST 1934. 17 ARE STILL HERE

Front row, from left; Gene Greene, JOE GREENE, Gene Harrison, John Chapeaux, Al Rider, Walter Clark, AXIE SPRENGER, EARL FOSTER, JACK SEBASTIAN, Bud Perl, Hite Mytinger. 2nd row: REX RADFORD, Russ Harrison, John Ward, CLINT HALLOCK, LOUIE BURGER, Colin Hill, DALE HARMAN, CLIFF SMITH, BOBBY AYOTTE, D. C. Vanderveer (d), Paul Eskew, GENE SMITH. 3rd row standing: JACK THRASHER, Paul Birdeck (d), Kent Wheeler, Lon Wheeler, Burt Biddle, Bill James (d), AL BRIGGS, Art Mathewson, Al Sharp, Joe Seamons, Margaret McNab, Bob Rotzler (d), NED PRICE, Coburn Marston (d). Top row: BABE WARE, Mike Linley, POP SEYMOUR, "Little Pete" Peterson, Dick Grenfell, GEORGE POTTS, Johnny Charlton, Lee Walton (now head of rocket engineering at Douglas) and W. D. Smith.

and he spent weeks trying to arrange an R.F.C. loan and laying the groundwork for a new stock issue. Some weeks the men were paid in full; other times he and Marston dug into their pockets to get enough to make partial payments. Finally, at director Jackson Hicklin's suggestion, they made a compromise solution by borrowing against receivables (unfilled orders).

"March 7, 1934: To Los Angeles. Nothing but trouble or discouragement. Kinner did not want second manifold yet. Vultee not ready, might want changes on next. Lockheed wants change in Y section. At Douglas was criticized proper for tank end stampings. Really was a poor job. Too much rush."

Though Art Mathewson was helping on L.A. deliveries and collections, Price was still carrying most of the load on getting orders, figuring estimates, buying materials, interviewing job hunters, soothing cases of injured pride, improving liaison among department heads, inspecting the plant once a week, writing copy for newspaper publicity, trade journal articles and an occasional ad, collecting material for a manifold catalog, pushing patent applications, and talking to various and sundry visitors with ideas of one sort and another for making items generally unrelated to Solar's business. (Most had no money, but one man paid $50 in advance for some design and drafting work on a two-man submarine. Another wanted prices on casting plaster models of dinosaurs.) The directors finally passed a resolution to pay Price a salary of $75 a week, Coburn Marston $37.50.

You look at the faces of Solar's 42-man crew, taken in August 1934—serious, in dead earnest, shouldering along with Price and Marston the job of keeping the plant one jump ahead of its creditors. They were working with a new material—stainless steel—and had to figure out the answers on welding and processing pretty much by trial and error. And though you might think an exhaust manifold—just a curved and sectioned pipe, really, ringed with "port legs"—could be easily standardized, each different engine required its own exact design and fit; each job had its own problems. Earl Foster and Joe Greene had headaches a-plenty (still have them, after 20 years) figuring the cutting, welding, fitting. Everything was pretty much hand operation, and everyone had a hand in every manifold, at one point or another, shifting jobs to keep the small orders moving. It was handy, though. Joe Seamons coud check on a part in about ten strides, walking from his board in one corner of the buiding past the new drophammer and along the four welding benches under the north windows in the 50 by 200 ft. shop. They worked as a close-knit team, utilizing their combined skills and individual ingenuity to back up the boss, out getting orders.

When Price returned from a one-month 10,185-mile sales trip in November he found things running smoothly, but orders had dropped. Aside from growing competition, they were encountering another problem: some of the Solar-designed manifolds, built and priced on the expectation of repeat orders, were being bought as single items and duplicated in competitors' shops. (One customer was soon making

ORDERS CLIMBED—and so did Solar. By 1936 the company had expanded from 1-story Bldg. 1 on Juniper into 2-story Bldg. 2, leased for 15 years.

its own manifolds by Solar methods, from Solar prints.) Since design engineering costs ran around $2500 for each job, they stood to lose a lot unless the initial expense could be absorbed in subsequent volume orders. The February 1935 books showed a $2000 loss—the first in 26 months. They were still borrowing on receivables to make the payroll; by the end of April it had increased to $2500 and the 64-man crew was working two shifts trying to make a dent in unfilled orders. (The men were tired. Though they were trying to rotate the work, some of it was being subcontracted.) In June a Medical Department was set up at the plant, and everyone's spirits rose when the new power hack saw arrived.

Returning from another eastern sales trip in October, Price found finances in a snarl again; Lon Wheeler wanted to resign and go into the prefabricated metal home business; the shop was behind on orders; there was waste in cutting raw materials. He called the crew together for a down-to-earth talk, started working up a new system of cost control. No one showed at the December directors' meeting. Despite the desperate need for additional capital, however, he believed they'd pull through.

1936 was to mark a real turning point for Solar, though they were *still* skinning through on payrolls. Three Japanese from Mitsubishi came in in March. "Wanted to know details of heat treating—learned nothing." Three months later, a Mr. Yamamoto of the same firm was in with U. S. Navy authorization, wanting to see how manifolds were made. "Said they'd bought one of ours but couldn't duplicate it. Took on fast trip without showing modeling or much else. Gave him lunch and out." May's figures were the best in Solar's history (unfilled orders at $85,000) and steps were taken to obtain trademark protection on Solar's flying sun triangle, designed by Harold Holmes in 1930.

On July 21, 1936, the stockholders voted to exchange the stock of the Delaware corporation for stock in a new California corporation, the fiscal year-end was changed to April 30, and in August, Solar obtained a 15-year lease on Building 2's north wing, including the termites. Sale of $50,000 of stock in the new corporation was approved in September, and by November new money—the first in five years—was being deposited to pay off old accounts and bolster the firm's credit. November's sales were $24,244—an all-time high—and employment had passed the 100 mark. The year ended with a 6th Anniversary dinner meeting of the Foremen's Club, attended by prominent civic,

PRODUCTION IN 1936 still centered in Bldg. 1's 50 x 200 ft. shop.

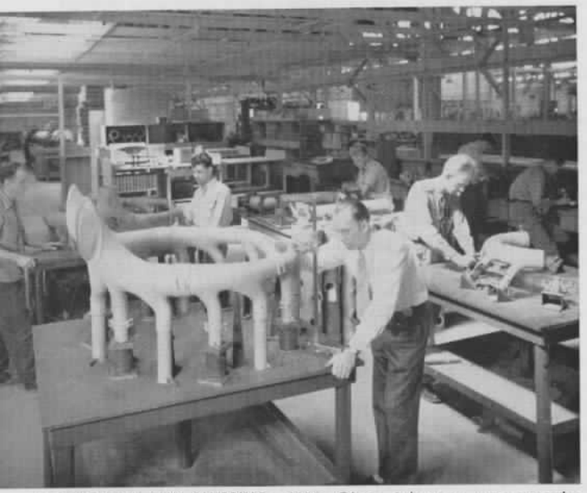
service and aircraft personnel, commemorating the delivery of Solar's first manifold to the Naval Air Station—and at the December 23 directors' meeting a motion was made and seconded to pay a dividend of 5c a share. *"End of a long struggle at Solar,"* wrote its president, *"to make this a dividend-paying outfit. A grand feeling with company out of debt except for current accounts after eight years of work."*

By March 1937 unfilled orders were up to $130,000. Stockholders received a second dividend of 2c a share, employees, of whom 13% were stockholders, received a pay increase of time-and-a-third for Saturday work, and in April permission was granted to sell a second issue of stock—with 10% to be set aside for subscription by employees at $2.50 a share. (It's now selling at $17.) Extensions to Building 1 were being planned, along with the purchase of new machinery. That month, too, Bill Heath joined the Engineering Department as an assistant to J. J. Van Vechten, Myrtle Florence was appointed stock transfer agent—and everyone got a week's vacation with pay.

In June, back from another extensive cross-country survey and selling trip, Price interviewed Cy Oberg, who wanted a summer job. ("Gave him one cleaning up the north building . . .") The word was getting around that Solar was on the upswing; more and more people were applying for jobs. He set two typists to copying Form 23 for the S.E.C. (Form A-1, with corrections, had taken a month.) The first anniversary of the California corporation was celebrated with a Craftsmanship Contest in July; in August he wrote, "New lavatories completed and dedicated." Later in the

ENGINEERING—1938: Chief engineer Joe Seamons, left, rounding out 10 years with Solar, moved his desk upstairs to the southwest corner of Bldg. 2 across from president Price's office, in 1934. With him is Bob Rotzler, helping on drafting as manifold shipments reached the 5000 mark.

THE SHOP—1938: By mid-year Solar's backlog topped $300,000. $12,000 was earmarked for new machinery, including a high-speed shear, and construction started on 120 x 180 ft. Bldg. 3, to right in photo. Joe Greene, foreground, was a 6-year oldtimer with a welding torch.



INSPECTION AND SHIPPING—1938: Closer tolerances were creeping into manifold production—.015 on most diameters, .005 on port flanges. Art Greer, right background, recalls that only two or three men knew how to read an NF-3 thread gage. Today's jet part tolerances average .003.

month, he was back working on amendments to Form 1-A, but he took time to meet with Charles T. Leigh, materials supervisor of Consolidated (San Diego's third aircraft firm, started here in 1935) and Claude Ryan as guests of the Associated Manufacturers of San Diego, who were interested in forming a vocational school to train more people in the metal-working trades. San Diego's three aircraft firms had reported a $13,500,000 backlog and were beginning to feel the shortage of skilled labor.

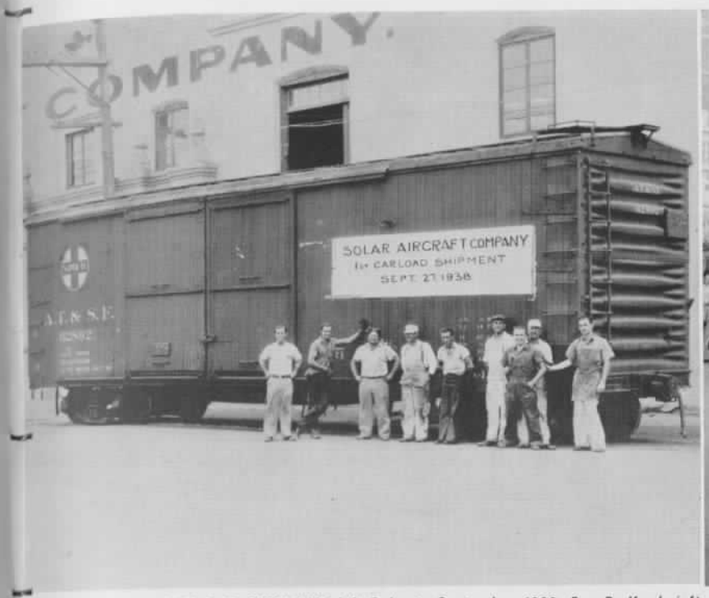
By October Solar's payroll had climbed to $7000. Solar was, you might say, growing up. There became evident a growing concern for the welfare of its 200 employees over and above the weekly paycheck: George Stone was advising gratis on the drawing of wills, and consideration was being given to some form of group insurance and a pension program.

By the end of the year the weekly payroll had mounted to $11,200. The little company was feeling, indirectly, the effect of a gradually increasing activity in the aircraft industry on both the west and east coasts—Martin in Baltimore was doubling its floor space to meet the demands of domestic and foreign orders—and Solar's six engineers were working around the clock on manifold orders from Martin, Sikorsky, Curtiss-Wright, Bell, Fairchild, Chance-Vought, Pratt & Whitney, Pan American, Lockheed, Northrop, North American, Douglas, TWA, American Airlines, United Aircraft Exports (who'd shipped 35 to Japan), FleetAir in Canada. A firm in Copenhagen wanted the exclusive rights to sell Solar manifolds in Norway, Sweden, Finland and Iceland.

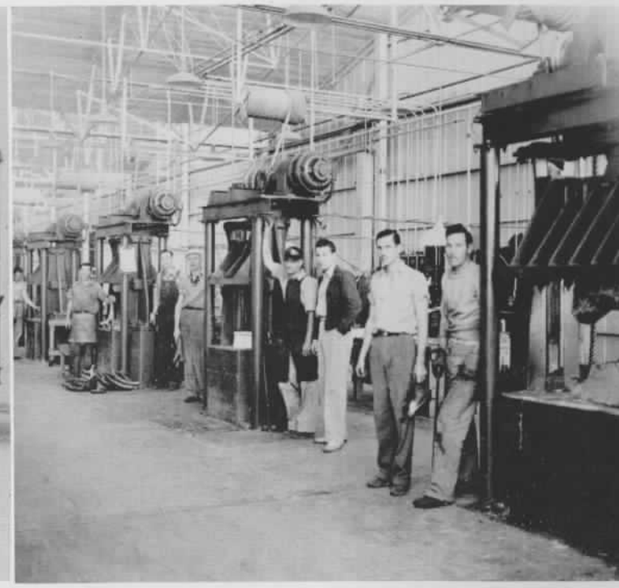
Solar's sales in 1937 had mounted to nearly $400,000, almost double those of 1936, and the books showed a $248,000 backlog. That Christmas the men set up a tree in the shop and the boss readied his house for the annual holiday avalanche. Solar's president could have reason to believe that his company, still in its first decade, was growing into something worthwhile.

On the flyleaf of Ned Price's diary for 1938 is written: "*On the plains of hesitation bleach the bones of countless millions who, at the dawn of victory, sat down to rest—and resting, died.*" He'd worked hard, at a grueling pace, for nine years—but there was no thought of letting up on the job. There was much to be done. Solar was still, essentially, a job shop—a 200-man 2-shift operation turning out 75% of all the exhaust manifolds being manufactured in the United States. If its business were to grow on the basis of manifolds and other engine accessories alone, the efficiency of the various work sections would have to be raised more—much more. No longer could he attempt to handle alone the correlation of the hundreds of details mushrooming up all over the plant.

They'd hired a purchasing agent late in '37, and Price had *finally* found a secretary who looked as if she were according to specifications. Eunice Carter, up from the Chamber of Commerce in February, had answered his famous "cloth problem" right off the bat. ("How much does a piece of cloth measuring 9 ft. by 3 ft. cost, at $1.50 per square yard?" Simple? You'd be surprised at the answers he got!) She was to serve him untiringly for many years, assuming more and more responsibilities as the unending details mounted. Art Mathewson had been made a director and vice president of sales, and in May the supervision of the Planning Department was added to *his* duties. Al Briggs had taken on the supervision of Cost Estimating and Cost Analysis. Lon Wheeler, whose brother Kent was soon to be placed in charge of the new sales office in New York, opened in the summer of 1938, was forging ahead as plant superintendent



FIRST CARLOAD SHIPMENT left Solar in September 1938. Rex Radford, left, and Earl Foster, third from right, are still with the company—have seen it grow from a sheet metal job shop to today's complex of specialized skills integrated with automatic high-precision machinery and flow-line production techniques.



HAMMER ROW—1939: $225,000 in orders received within one week in September kept the five new drophammers pounding on carload lots of stainless sheet. Solar's insistence on quality was paying off. Still with the company: Vern Yates, Roger Durden and Ed Beiswenger, above.

Les Earnest in the Research Department, set up in a small way early in 1931, was scheduled to take over the testing of manifolds—now nearing the 5000 production mark. (Solar's exhaust systems were holding up well; some, reported American Airlines, were still in service after more than three years.)

By June, unfilled orders were at $309,163. Employment had doubled, and plans were underway to double production floorspace by adding a one-story 120 x 180 ft. steel saw-tooth roofed extension north of Building 1. Over $12,000 had been earmarked for new machinery, including a new high-speed shear. A new Process and Tool Engineering Department was set up in August under hefty W. D. Smith, with Faye Smith and Bill Heath as assistants, and Pop Seymour's son Clyde came in to see about a job. (That month, too, a director's table, 12 chairs and two desks were purchased out of Agua Caliente's dismantling.) A new multistage die process—later patented as the "Sol-A-Die" sheet metal forming technique—was being tried out in the Hammer Department, and in October, Price wrote firmly "Company over the hump."

"*November 18, 1938: Taxi to Pier 90 and boarded the Queen Mary. Still seems fantastic. Enroute to England.*" Since Hitler's absorption of Austria in March 1938, tension had mounted steadily in Europe, and Price decided to make a first-hand survey of conditions on the other side of the Atlantic. After seeing examples of German, French, English and Polish aircraft at the Paris Air Show, he observed, "Wonder whether our watchmaker's accuracy is necessary, especially in crisis where volume is paramount . . ." In England, after touring the Rolls-Royce plant in Derby, the de Havilland plants in Edgware and Hatfield ("good looking drophammers") and talking with representatives of Bristol, Armstrong-Siddeley and Napier, he learned from the British Air Ministry that Great Britain would need 5000 engine manifolds in 1939. His trip had been necessarily brief, but there was no doubt in his or anyone's mind that Europe was on the brink of a second war.

Back at the plant in December, he told us what he'd seen abroad; prepared for more building space; ordered more drophammers, lathes, punch presses and welding equipment. Building 3 neared completion in May and the plant wound up to three shifts following a $90,000 order from Glenn L. Martin for manifolds and cowlwells. By June, Solar's backlog had mounted to $325,000.

In August 1939 Solar's first contract with the United Aircraft Welders of America was signed; though not all of Solar's welders were in agreement on the classification schedule clauses, the shop had voted by a 60% majority to join the union. That month, too, Harry Campbell (now head of Bell Aircraft's metallurgical laboratories) was appointed to direct the Research Department. The following month, $225,000 in orders were received within one week and stainless sheet was trundling in on the Belt St. spur track in carload lots as Joe Seamons and his engineering crew, now almost a dozen, kept the vellums rolling on orders from American Airlines, Braniff, Delta, Eastern Airlines, K.L.M., Northwest Airlines, Pan American, Swissair, T.W.A., White Pass and Yukon, plus 13 other foreign airlines—and the airframe and engine manufacturers: Bell, Bellanca, Boeing, Cessna, Consair, Curtiss, Douglas, Fairchild, Fleet of Canada, Fleetwings, Howard, Hughes, Lockheed, Martin, North American, Pitcairn, Pratt & Whitney, Republic, Spartan, Stinson, Vega, Vought-Sikorsky, Waco and Wright.

1939 saw start of Bldg. 3, but canneries were still close by—Westgate, left, Calpack on Juniper, and Neptune. Bldg. 4, above, went up in 1940, followed by 2-story Bldg. 5.

1939 had been a big year for Solar. 1940 was to mark more milestones as more and more cars pulled up on the two logged-off parking lots between the spur track and Pacific Highway, jockeying for space with Westgate and Calpack employees. (Parking was beginning to be a problem for all three of San Diego's aircraft firms, now employing 5,368 people drawing a combined monthly payroll of $675,000. About half were newcomers to the city, and the Vocational School was scheduled to train 3000 more local residents to meet the industry's growing demand for skilled metal workers and machinists.) Solar had 465 on its $50,000 payroll, and in February a $180,000 order for manifolds came in from Convair—one of the largest ever received by the company.

Joe Seamons, who'd been with Solar for 12 years, resigned that month to go to Vega Aircraft, and Leonard Allen was named chief engineer. (That month, too, the "Solar Blast" made its bow—edited by George Little, who got Al Briggs to help him run off 600 copies on the mimeograph machine after Eunice Carter had typed up the stencils.) Solar's lease was extended another 15 years, and plans were soon underway on Building 4, a 60 x 170 ft. one-story addition to Building 3, and Building 5, a two-story addition to the west side of the rapidly expanding production area.

By March 1940 the books showed a $1,250,000 backlog and shipments were streaming out at the rate of $100,000 per month. Solar's 10,000th manifold was completed in June, and by September its employment rolls had climbed to 600, still working three shifts. Even so, we were a close-knit team in those days. Everyone, including the boss, had fun at the annual picnics. Cy Oberg, working in Research, was president of the "Solar Flying Club," a cooperative venture working to buy themselves a Piper Cub; Earl Foster, in Jigs & Fixtures, was working on a "Mutual Assistance Club" to round up volunteers on weekend home building projects; Les Earnest had spearheaded the formation of a Credit Union early in 1940 (99 members, $1072.50 deposits); Tony Hemmer and Bob Cooper had declared themselves members of the "Solar Aircraft Amalgamated Association of Frog Leg Fanciers"; and 59 of Joe Seamon's friends at the plant gave him a bang-up farewell dinner, complete with special titled menus, when he left Solar. There was a friendliness and certain esprit about the place that helped to balance off the tension of production bottlenecks—just as there is today within the individual departments of the company's giant-sized complex.

It was that same spirit that, in March 1941, led the men in the shop to vote for the "Solar Employees Association"—an independent, voluntarily organized group of production and maintenance men exclusive of welders—as their bargaining agent during the C.I.O. Automotive Workers Union's entry into the San Diego industrial scene. Solar welders had signed a no-strike, no-lockout agreement in January with the company—and a similar agreement was signed by the S.E.A. in March.

SOLAR-1941: Neptune building, extreme right, was acquired in August. There were 1300 on the payroll that month, and the September backlog climbed to $11,285,000.

Solar's sales in April 1941 represented a 75% gain over those of the previous fiscal year, and the books showed $8,500,000 in unfilled orders. By August there were 1300 on the payroll, and the Employment Department moved from its small office downstairs in Building 2 to new quarters in the Neptune Building, where it is today. (Bill Gilbert, who'd joined Solar in May '39 as its first personnel director, was succeeded in July by Eldon Carl.) Throughout the plant, efforts were being made to increase production, keep quality up to standard, and cut down on waste and inefficiency bound to crop up when a company suddenly finds itself coping simultaneously with expansion problems and volume orders. Don Parkin was named sales manager in July following Lon Wheeler's resignation, and Price, back from Philadelphia where he'd arranged to have part of Solar's work subcontracted by the Budd Company, set the wheels rolling for the acquisition of all land between Lindbergh Field and Hawthorne St., Harbor Drive and Pacific Highway— plus the purchase of the Potter Radiator Company's saw-toothed plant in National City. Late in August he and Earl Foster flew to Seattle to make a tour of Boeing, Solar's first major customer, to see what they could learn about assembly line techniques and efficient plant layout—and in September he returned to Philadelphia to see how Bill Heath, Jack Oatman and Joe Greene were making out at Budd. (Joe was teaching women to weld.)

By the end of September, Solar had $11,285,000 in unfilled orders, of which $5,500,000 were to be subcontracted to Budd, and in October the Inspection Department braced itself and took on five women as inspectors. (Jo Folsom was one of them.) Hite Mytinger, who'd hired on late in '31 to help Kent Wheeler weld five manifolds for North Island, had been moved up to Factory Superintendent, succeeding Vince Hardy, and Elvin Binger, who'd been bandaging cut fingers in the First Aid cubicle in the middle of the production floor for nine months, was made supervisor of the expanding Safety and First Aid Department. Earl Foster was appointed to head the new National City plant, purchased in November, where 225 men were scheduled to work three shifts on cowlwells. Don Miller became general superintendent of both plants, and that month Solar's second branch sales office was opened in Los Angeles.

On November 7, Price, back from Philadelphia, spoke to Solar's 1800 employees, enlisting the support of U.A.W.A. members on their no-strike agreement in the general strike scheduled for November 10—one day before Armistice Day, less than a month before the attack on Pearl Harbor. There was no strike at Solar, and the following week the company granted pay increases and retroactive pay to members of the Solar Employees Association.

"December 7, 1941: Had just finished the 18th hole at the Solar Golf Tournament at Coronado when we received the news of Pearl Harbor . . ."