Some duplic

– National Steel Car & Victory Aircraft

Mario Pesando ~~the Boeing Engineer~~

I graduated from the University of Toronto in 1942 with an Engineering Degree in Aeronautics and Physics.

The National Steel Car & Victory Aircraft Years May 1942 to October 1945

After a short stint at the RCAF base at Camp borden where I completed my COTC training course, I joined National Steel Car at Malton, Ontario as a Weights and Standards Engineer. W.U. "Bill" Shaw, Chief Aeronautical Engineer assigned me to the Lancaster Bomber Production program which had been awarded to the company just a few months earlier. The job was not particularily thrilling as I spent most of the time adapting American/ Canadian parts, mostly fasteners, as substitutes for the British items called for in the A.V.Roe drawings which had been produced by the British designers of the Lancaster, and materials, specifically Aluminum alloys and their heat treat specifications. In addition I spend considerable effort in cajoling the production crew in suppling the necessary equipment and muscle power for weighing the aircraft components as they came out of the jigs in order to determine that the Canadian built Lancaster, designated as the Lancaster X (meaning "ten" and not "unknown" I believe) complied with the weight and balance (the location of the center of gravity of the Lancaster) specifications. This exercise was quite important since with the substitutions of North American parts, materials and equipment in lieu of the British specifications, as well the impact of Canadian workmanship, the flight performance of the Lancaster X could have been compromised if the weight had exceeded that contracted for. During this weighing exercise I had prepared a weight and balance estimate, based on the British data, of the aircraft components leading up to a final value for the Lancaster. In this manner I was able to predict what impact that the substitutions would have on the first production Lancaster aircraft. All was well as the Lancaster X weight and balance were within the specified values.

I was fortunate that as a result of this effort I was called upon to prepare the aircraft loading and balance data for the test flights which brought me in contact with the flight test personnel, the pilots Ernie Taylor, Don Rogers and Bob Wingfield as well as the flight engineers such as Tommy Thomson, radio operator Fred Lake as well as the flight facility supervisor, Dave Wagner. I had prepared this data for the Flight Test Liaison Engineer, Jerry Dumulong who had also been hired by the Chief Aeronautical Engineer, W.U. Bill Shaw, to prepare and in conjunction with the flight crew to conduct special flight tests for evaluating the performance of the Lancaster X. As result of family illnesses who were located in Montreal, he was absent for periods of time and finally resigned as he could carry out his assignments.(I had been filling in his absence.) Following his departure I was given the job as Flight Liaison Test Engineer and the real fun began!

In addition carrying out the special performance test on every fiftiest aircraft, I became involved with the day to day remedial actions in clearing up the "flight snags" that the test pilots discovered in their flights. It was my responsibilty to determine the causes relating to the aircraft flying characteristics and come up with a solution. Although most of the "cures" were out-lined in a special handbook prepared by the British test engineers, there were still quite a number of unusual problems did occur, which required considerable analyses. During my assignment to the job of Flight test liaison there were 4 events that I vividly remember. For the record in a short period of time, that is from March 1942 (Lancaster contract award) until August 1945, the company built 400 Lancasters, 10 Lancastrians used by Trans-Canada Airlines for trans-Atlantic service, one York and one Lincoln aircraft all within a period of 40 months.

1) Lancaster X Tendency to fly wing low.

Every now and then the test pilots would report that the Lancaster required abnormal amount of aileron trim to maintain the wings level. That is for zero bias on the aileron trim tab, the aircraft would fly with one wing low.. This was caused by a small amount of wing twist in the outer panel probably brought about by built-in stresses on the panel as it was being fabricated in the wing jig. Once the completed wing panel was removed from the jig there was a tendency for the panel to twist a trifle. This was a random occurrence and could not be predicted, or even acknowledged by the production staff. A second contribution to the wing "low" was the sensitivity of the position of the Frise (designer's name) relative to its position on the trailing edge of the wing. According to the designers' manual there were two fixes for this:

a) If it was the aileron causing the problem, the the remedy was to shim one of the aileron's hinge line up and see what happened. The actual ground time required was a matter of an hour or so to add a shim, but a test flight would be required to assess the effectiveness of the. The other fix was to shim the entire trailing edge of the wing panel itself, which in effect produced a counter twist alleviating or cancelling the residual built-in wing panel twist. This required several shifts to achieve with the probability that either too little or too much shimming had been applied, which could only be established by flight test. Although

the incident rate of flying wing low occurred randomly, it still played havoc with the timely acceptance of the aircraft and it was not uncommon to have quite anumber of Lancasters backed up awaiting fixes and additional test flights. The aircraft production rate was running about one a day. This problem combined with a few other types of incidents was becoming embarrassing and extra-ordinary action was needed.
With the help of the Tool Engineering who designed a precise fixture for measuring the twist in the completed wing panel, we were able to select and "pair" the right and left wing panels prior to installation onto the centre wing and fuselage section of the Lancaster and were thus able to cancel out the difference in the angle of incidence between the port (left) side and the right (starboard) side of the aircraft. Once this program was instigated there were no longer any incidences ot wing "low" during the remainder of the production program. This action reduced the number of flights per aircraft from about eight to three required for acceptance. .

2) Directional Wandering

A particularily vexing problem that arose was the tendency of the Lancaster, again on a random basis, to wander or weave in level flight. This phenomena was particularily disconcerting to the pilot since the magnetic and the directional compasses would also oscillate a few degrees about the heading reading. The Avro engineering manual made no mention of this type of problem so we were completely on our own. We tried all sort of minor fixes such as biasing the rudder trim and servo tabs, resetting the twin rudders so that the aerodynamic forces would "load" the rudders in such a way to remove any play. Sometimes these fixes appeared to work but were not consistent nor rational. A large number of flights were devoted to chasing this problem. I reviewed all the past snag sheets and flight reports for all the Lancaster X's from the first aircraft KB 700 the "Ruhr Express" and finally a pattern emerged. In order to conduct the more comprehensive fligt tests such as the speed, rate of climb, and maximum dive speed at 360 miles per hour indicated air speed (a real white knuckle situetion, more on this later) we installed all the gun turrets, guns and appropriate fairings in order to establish the authenticity of the configuration of the Lancaster X as it would be on an operational bombing mission. These turrets had been supplied to the company by the British Air Commission for these special flight tests. Since the turrets were not produced in Canada and since it was more expedient to deliver the aircraft with steamlined covers in place of the gun turrets since the drag of the Lancaster would less and thus improve the mileage per gallon; much to the relief of the Ferry Command pilots who had to fly the aircraft across the Atlantic ocean.

During the early phase of the production run, the turrets were more freqquently installed in order to establish the integrity of the new Lancasters. The records revealed, at least to me if no one else that there were no occurrences of wandering reported by the pilots. I discussed this with the flight and ground crews and received a deaf ear. The problem still persisted and in final desperation I approached the general manager, Dave Boyd, or was it the other way around since the aircraft were not meeting their scheduled delivery schedules. He called a meeting but with the opposition that was facing me, I could not get the majority to accept my findings. Since there was no alternatives I won by default and Dave Boyd instructed the supervisor to install a set of gun turrets. on the Lancaster which had the worst case of wandering. To every-one's surprise (except myself) the aircraft flight test was a success and there was no sign of wandering. In order to establish that the rudder trim and servo tabs were not the cause, we set these tabs to what we considered the worst case to endeavor to re-create the wandering. In now way were we able to cause the Lancaster to wander. I had concluded that it was not so much the shape of the substitute turrets that were installed originally, but a pair of fairings (which had been removed) which were used to reduce air currents at the forward end of the rear gun turret so that the spent ammunition casings would fall free of the aircraft gun turret and not jam the turet rotating mechanism. The problem was solved and the the substitute wooden gun turrets were re-configured to match the real thing. The fairing for the shell casings was also installed as part of the package. We now had the two major problems solved and the Lancaster X delivery was back on schedule.

PICTURES

3) Calibrating the Airspeed System

The contractual reqquirements specified that every fiftiest, undergo a flight calibration of its airspeed system. The procedure that had been adopted by the company was to install a test panel containing a few flight instruments comprising an altimeter, an airspeed indicator and an aircraft clock. The latter was always hard come by since they were constantly being liberated! This simple test panel was connected to the Lancaster's pitot head and static vent system and located at the bombadier's station in the nose of the aircraft. The operating procedure was to fly early in the morning when the air was relatively calm, along a measured distance (about 20 miles) derived from land survey charts, at about one or two thousand feet above the ground.

The flight was made in both directions to eliminate any wind effects which hopefully did not change during the trials. The pilot endeavored to fly at a constant airspeed and altitude. Due to the time involved and the strain on the pilot, let alone the effect on the neighbourhood below, only six or less complete runs were made. The route that we selected ran between and Kleinberg on highway 27. Unwittingly I volunteered to be the data recorder(in those austere days we didn't have camera recording devices). What a ride! In spite of the so called calm air, the airccraft kept bouncing all over the place and recording the readins at 10 second intervals left a lot to be desired with respect to accuracy. MAP

The technique was to start the stop watch as we crossed the starting point, in this case was the intersection of a road crossing high-way 27 at and write down the airspeed and altitude at specific intervals through-out the run which would last any where from 5 to 10 minutes depending on the selected airspeed. Upon reaching the end of the run, this being the road which crossed the highway at Kleinberg, the stop watch was turned off and the total time for the run was clocked. The return run was timed in going from Kleinberg to to obtain an average speed to compensate for any wind effect. Thes paired runs were then repeated at different speeds. The total exercise took several hours since the time and distance required to reach a stable speed took longer than the runs themselves. Following completion of the test flight the readings taken of the airspeed indicator for each run, was averaged to obtain a mean value for that particular run. Corrections were then applied for temperature and pressure and the results were then plotted. The scatter of the corrected test points were in my mind of dubious value and I was determined to find d better way to achieve this. (TYPICAL CHART?)

Since the main thrust at the company was to produce Lqquality Lancasters as quickly as possible, the emphasis was on the good tooling (which was superb) , machining and fabrication with relatively little emphasis on what I would call aeronautical engineering. To put it in blunt terms it was really not required in the Canadian since all the design had been accomplished by the engineers in England. I had no soul mates to discuss aerodynamics which included performance and stability and handling of aircraft.

I could not convince my peers that the errors in airspeed indicated by the pilot's instrument was influenced by the static pressure field surrounding the aircraft in flight and NOT due to the variation in the incidence of the pitot head which measured the dynamic air pressure. Stated another way, the pressure measured by the airspeed indicator was the difference between the total pressure sensed by the pitot head minus the static pressure field surrounding the aircraft which was sensed by the static vent which was a point on the side of the fuselage selected by the aircraft designers. The static vent served to purposes; it was used supply the static pressure as to the airspeed indicator as nnoted above and to supply the aiecraft altimeter the outside atmospheric from which the altitude of the aircraft was derived. It was this simple hole or orifice that as the angle of incidence, or attack, varied in proportion to the aircraft speed (the angle of attack increases as the speed of the aircraft decreases) would in effect impact the true indicated airspeed reading and would need correction for navigation and other flight functions. I concluded that the simplest way to determine the correction factors was merely measure the true height of the aircraft above the ground, compare this true height to the aircraft height as indicated by the altimeter for different airspeeds. I was finally able to try this procedure on the first Lancastrian, a Lancaster X converted for carrying passengers which was to be delivered to Trans-Canada Airlines who were given the responsibility for air service across the Atlantic. With the co-operation of the photographic department, headed by Ian Phemister, I had one of his photographers position himself on top of the hangar and to shoot straight up as the Lancaster flew overhead. I was in the Lancaster and as we passed over the hangar recorded the airspeed and alitmeter read-out. We made about 10 passes in less than half an hour. By scaling each photogragh I was able to determine the true height of the Lancaster above the ground. After applying the usual corrections for the effect of air temperature and barometric pressure I was pleased to discover that the plot of the test points followed a curve with little scatter and were both believable and meaningful. When the chief test pilot for Trans-Canada Air-lines came to take delivery of the Lancastrian he was loathe to accept my airspeed correction results. He later informed me that after many hours of flying a measured ground course near their Atlantic headquarters in Montreal he was able to confirm my results, but failed to achieve the low scatter that the technique we had used. I found out later that this was the procedure commonlly used in England; our Trans-Atlantic communication in these matters was non-existent. I had just re-invented the wheel! It was good for the ego.

4) Flight at maximum Speed — Don Rogers 380 mph — Laurie Parachute

5) Bombing Malton Airport — Marsh Wright (Dorval)

6) Close Shave on the York Freighter — Flaps down with [illegible]

— Gaard Stuck