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251.9 (F) TURBO SUPERCHARGERS

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FILE NO.
528.8641-9
Sep 41-Dec 48
TO BE RETURNED TO THE ARCHIVES OF THE AAF HISTORICAL OFFICE

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September 22, 1941

Brigadier General O. P. Echols,
Chief of Materiel Division,
Office Chief of Air Corps,
Washington, D. C.

Dear General Echols:

On Saturday, September 20th, I inspected the turbo supercharger developments up at Bristol. The installation is being made on the Hercules engine using two P-superchargers, for eventual installation on the Wellington V two engined bomber. The installation seems rather clean, ducts are free from sharp curves, flexible joints between the engine and turbo. The turbo is mounted on rubber on the engine mounts. Inter coolers look very good and although they have been tested their adequacy is still somewhat in doubt.

They are planning a critical altitude of 40,000 feet on this installation and in order to get it the engine is equipped with a two-speed blower. Critical altitude in the lower blower is 5,000 feet and in the high blower, 15,000 feet. Figuring that when the 25,000 feet obtainable from the turbos is put on top of that, they will have their 40,000 feet. We pointed out to Peddon that we had been in some difficulty when using turbo superchargers in connection with high blower ratios in the engine where opportunities for inter-cooling did not exist and called his attention to the fact that charge temperatures might be excessive, causing incipient detonation and consequent overheating of the engine.

Also, they appear to lack information on fuel system operation and ignition difficulties which may be encountered at great heights. It is a bit difficult to point these facts out to the Bristol engineers because of the fact that one of their specially built airplanes now holds the world's altitude record. However, I believe that they realize they are up against an entirely different problem when designing a supercharger installation for sustained operation at high altitudes.

Due to the fact that I have not been intimately connected with supercharger installation recently, I was unable to furnish detailed information which would be of particular assistance in the case. I believe that it would be a smart move to send Robie over here for a month or two to get them straightened out on this job.

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While they are all enthusiastic about the installation, I am afraid they are planning on getting too much out of it and if it is a flop, they may go to the gear driven two-stage supercharger, which they have designed and flying in this ship. I am sure they will greet Noble with open arms and welcome any suggestions he might have to offer.

This bears out your original contentions in the matter and while the General Electric representative is rendering all possible assistance, it is quite possible that even he may be too optimistic as to what can be done.

Things are extremely quiet here at the moment. I haven't seen a German airplane or heard an alarm since I arrived. I have been kept extremely busy visiting plants including as many as 5 or 6 in one day, trying to collect information on the maintenance and repair situation. One of the most serious things we are confronted with at the moment is the modifications that are deemed necessary on American aircraft before they can be put into operation. Airplanes sitting on the ground for weeks and sometimes months while necessary modifications are being made. I have revised my opinion considerably as to what we should do about this, believing now that it is more important to do the work away from the combat zone, rather than send the aircraft over here where the work is being done with insufficient information, materials, workmen, facilities, etc. I believe it could be done much better before the aircraft are flown or shipped to the United Kingdom. However, General Brett will go into this matter upon his arrival so nothing can be done about it until his recommendations are in.

I have attempted to get the information you requested on the Warwick production and have gotten several conflicting reports. One day I was told the airplane was not going into production and when the official confirmation of this verbal statement came through it was entirely revised and it has been decided now to carry on with the original production plans. We are still trying to get the dope on exactly what the production schedule will be, but at the moment it has not been received. Things move exceptionally slowly sometimes around here and I am told that all we can do is be patient.

I will drop you a note from time to time to keep you informally advised as to what the score is.

Sincerely,

E. M. POWERS,
Lt. Col., Air Corps,
Special Observer.

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MINUTES OF MEETING HELD AT
AIR TECHNICAL SECTION, WFOUSA

5 May 1943

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PRESENT:

Lt. Colonel R.S. White	Power Plant Section, A.T.S. - Chairman
Major C.M. Taylor	M. & R. Division, VIII A.F.S.C.
Captain B.T. Stogner	Engineering Officer, 91st Bombardment.
Captain Butzel	A-4, Eighth Air Force.
Mr. A.A. Allan	Allison Engines, M.A.P.
Mr. Bird	Curtiss Wright Corp. (rep).
Mr. Bruce	M.A.P., P&W Engines.
Mr. Brauer	Curtiss Wright Corp. (rep)
Mr. E.W. Bossey	Wright Engines, M.A.P.
Mr. M. Graham	Pratt & Whitney (rep)
Mr. Jahnke	Allison (rep)
Mr. Tresillian.	Air Technical Section.
Mr. Thompson	General Electric (rep)

- AGENDA:
1. Informal talk on turbosupercharger by Mr. Thompson.
 2. Data obtained by engineer at Burtonwood re U.R.'s
 3. Statistical analysis presentation.
 4. Practical application of our suggestions.

The meeting began at 10.15 and Colonel White, after stating what was on agenda, introduced Mr. Thompson, Field Representative of General Electric Co.

Mr. Thompson:

The turbosupercharger will give you just so much and no more. It is designed to do a certain job and it was doing the job it was originally designed to do, but it is now being called upon to do more and more and consequently we are now having some trouble. We are developing new steels, and new devices in the field of technical regulators are coming - when, I don't exactly know and can't say. Frankly, I think the only way I can tell you what you want to know is for you to ask questions.

Col. White:

About 30% of power plant failures are on turbos. These are, in general on four-motored ships, and occur principally on the outboard engines. It seems to me that we should use the inner engines more.

Mr. Thompson:

In connection with performance, it is my belief that the cause of failure on outboard engines is not so much due to taxiing on the ground, but because the controls for outboard engines are on the top bank of the pilots control panel. Consequently, they are easier to grab. This discussion has taken place before and it was suggested that the controls be so re-arranged that if he grabbed anything he would grab all four knobs. Whether this was ever done or not I don't know. You can't hurt the turbo on the ground.

Capt. Stogner:

Do you think the short tailpipe on outboard engines makes a difference? There is another reason: there is quite a bit of lag between the inboard and outboard engines.

Col. White:

In that case it would be a good idea to have the Nos. 2 & 3 engines operating at a higher power.

Mr. Tresillian:

You will then have more margin on the outer engines.

Capt. Stogner:

They usually set the inboard and use the outboard to stay in formation. They set the inboard engines even.

Mr. Thompson:

The 97th. Group said this problem gave them a lot of trouble and

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they had to change 17 turbos, but they are now flying formation without setting their inboard engines. There is now an addition to the tailpipe of the turbosupercharger which aids regulation.

Capt. Stogner:

But how can you check your regulators on the ground when you get some 46 inches on the ground to begin with after installing this additional tailpipe?

Mr. Thompson:

You throttle back the engine while on the ground and then check your regulators before opening up to full throttle. This new addition is called the flame suppressor attachment, but the primary use for the thing has rather given way to its more important function as an aid to the supercharger. When between 26 and 28 thousand feet the wastegate lever, operating the turbo is in a very sensitive range. Closer to the ground you have to move your control in the cockpit through a comparative large range to effect changes in regulation, but the higher you go the less distance your control must travel to effect the desired changes. By the addition of this tailpipe you operate the wastegate at 20-26 thousand feet at the same control position as you normally would at from 26 to 30 thousand feet.

Col. White:

Do you go around to these stations for educational purposes?

Mr. Thompson:

Yes, I try to see them all at least every six weeks.

Col. White:

It seems to me that the pilots should have a change to meet with you when you make these contacts. Major Taylor, from U.R. data most of the failures are from bucket stretching; isn't that right?

Capt. Stogner:

Yes. Most of the troubles are from bucket stretching and cracking.

Mr. Thompson:

The pilot would never know if only one bucket was missing. Naturally it isn't advisable to keep operating with one bucket gone, but numerous aircraft return from operations successfully and then find that one bucket has gone out.

Major Taylor:

While you are on that subject, why do you have overspeeding of the turbo when the wastegate is closed?

Mr. Thompson:

If you put your hand over the intake of your vacuum cleaner you back it up to excessive speed because you have cut off the weight of air. Leaks would also cause overspeeding if you have leaks in the system.

Major Taylor:

What is the best method of testing for leaks?

Mr. Thompson:

Smoke tests are the best means of locating or detecting leaks. Visual inspection and actual operation are the other two ways. In the B-24 most pilots fly on turbo. On P-38 we had a lot of trouble at first (32 had to be replaced), but that has been ironed out for we have educated the pilots not to operate on turbo. Of course, it's a bit difficult to operate a fighter and adjust the turbo simultaneously. The regulator failures were overcome by educating the ground crews as to what to do. When we get the automatic regulator they will get just so much and no more. That will be a mechanical control and will not be adjustable. There will be a device whereby you break a seal, but 21,300 revs. will be tops, however.

Col. White:

For your reference, gentlemen, Technical Order 01-1-72 refers to the break-through seal device and Technical Order 03-10HA-5 shows the

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boost control.

Mr. Jahnke:

Have you any information on P-38 operation of turbo?

Mr. Thompson:

They are having bucket failures and it is just due to overspeeding. I might tell you that G.E. has developed a steel that will increase the speed up to 27,000 revs. a minute. It has been suggested that we get it over here for use on the outboard engines only. This may lead to a lot of dissension, however. The bucket is cast and not stamped - these samples are pressure die-cast and you can't tell them from the forged ones. (Samples distributed)

Major Tugger:

If you give them a supercharger to turn over 5,000 more r.p.m.'s won't that mean more engines out.

Mr. Thompson:

Yes, it will.

Col. White:

Engines are always operating on the verge of trouble and you can't get away from it. But that represents progress and the price we pay.

Mr. Tresilian:

Have you ever tried operating the turbo without the rims on the bucket? It would save about 10% in weight of the blade.

Mr. Thompson:

We have, but you lose a great deal through leakage and also the rim stops blade vibration.

Col. White:

Have you experienced any lubrication failures?

Mr. Thompson:

In the two years I have been over here we have had only two cases of lubrication failure.

Capt. Stogner:

Do you still use engine oil in the G.E. turbo?

Mr. Thompson:

Yes, we do. We have had a bearing failure on a B-24 and only two on B-17's. We have had cases of suspected fires in the turbo, but it was only after burning and these could have been remedied by leaning up on the mixture. We have taken pliers, screwdrivers and bits of safety screens out of the intake duct, also a variety of pieces of planes themselves. To impress on the pilots the seriousness of correct supercharger operation I take around with me a wheel that has been cracked to show them what can happen.

Capt. Stogner:

I think the Engineering Officers realize what is happening, but it is the pilots themselves you have to sell.

Mr. Thompson:

In a station composed of 90 flying personnel who had been having trouble with the turbo because they didn't know how to handle it or what they were handling I conducted educational courses and they have had little or no trouble since.

Capt. Stogner:

But you have to sell our pilots on flying with turbo control.

Mr. Thompson:

What is the proportion of turbo failures to engine failures? Or, let us say, turbo changes to engine changes.

Capt. Stogner:

I don't have those figures.

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Col. White:

I'd say about 30 to 50% as many turbo changes as there are engine changes.

Mr. Thompson:

First of all, we regard "failures" as those cases in which the turbo won't work.

Capt. Stogner:

We regard failures as any case in which we have to change the turbo. I would say that about 50% or about one-half as many "failures" are had with the turbo as with engines. If you give them a supercharger control that will give them as much power as the throttle then they'll use it to the limit.

Col. White:

I think education is the principal thing in this case, as in any other situation.

Mr. Brauer:

Does that added boost save many ships?

Mr. Tresillian:

Not only do we not know how many ships are saved, but we also do not know how many ships are lost by excess use of boost.

Mr. Thompson:

Don't you think that the failure of only the turbo is the lesser of two evils?

Mr. Brauer:

Yes, I do. It's easier to replace turbos.

Col. White:

I think we should go on to the second item on the Agenda and hear from the Engine Representative from Burtonwood.

Mr. Brauer:

I have some figures here obtained with the assistance of Mr. Bird, our representative at Burtonwood. I searched through the inspection records of 50 type 1820 engines at Burtonwood on which they had issued U.R. reports and of the mechanical failures, 16% - where no cause was traceable - constituted internal failures undetectable through 100-hour inspection. This group included valve washer failures. Sixty-eight per cent are due to piston rings, valve burning, etc., 20% of this group had nothing wrong. Twelve-per cent were shot through by shell and flak and are not actual U.R. causes. These are engines that have been overhauled and the inspection completed. There are a small number of cylinders on hand (200 odd) and every effort is being made to remedy this situation.

Capt. Stogner:

How many engines do these figures cover?

Mr. Brauer:

Fifty, but of course, they had more to be overhauled and on which the inspection had not been completed.

Col. White:

I suppose any cylinder head breakage had been taken care of before the engines had ever reached Burtonwood? How is the bearing situation?

Mr. Brauer:

Yes, there were only two cracked cylinder heads and two bearing failures on this list. Valves were the most serious. The time lag is about three months between the time the engine was pulled and the time the inspection was completed.

Col. White:

It is troublesome, but the only thing we can do is trace the

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causes as soon as possible. We may only be able to analyze 20% to 30% of the troubles, but it is decidedly a benefit, and will give us the trend.

Mr. Brauer:

Would it be possible when the engine is pulled to make the compression on the outside of the cylinders so that good cylinders can be kept at the stations as replacements on the engines?

Capt. Stogner:

In many cases the reduction gears are out and we can't check the compression. We don't want a new cylinder anyway. It takes just as long (7 to 8 hours) to run a new cylinder in as it does to run in a new engine.

Mr. Brauer:

A lot of cylinders are being robbled because of this.

Mr. Tresilian:

My suggestion would be that if the Stations do not intend to use the new spare cylinders then someone from Burtonwood should go along to the groups and perhaps locate a number of new spare cylinders that will never be used for subsequent utilization at Burtonwood.

Capt. Stogner:

A new run-in procedure was tried in the States, but 130 engines in one group had to be changed because of it. One B-17 ran only four hours.

Mr. Thompson:

Is it not the R.A.F. policy to change spark plugs when the engine has been overspeeded?

Mr. Fossey:

Yes, we can change spark plugs and also thoroughly inspect the engine.

Mr. Jahnke:

It is almost as difficult to get spark plugs as it is to get engines. We have a report pending on all the engines that have been to Burtonwood and will submit it in the near future. Particular stress is being placed on detonation. About four cases of detonation and three cases of burnt valves have been discovered so far. We are going to keep a running record on these engines at Burtonwood.

Mr. Graham:

I have been unable to get complete figures, as yet, from Burtonwood, but I have received a fair report from the Groups in the field. My information is in the making now and I'll get the figures to you as soon as possible.

Col. White:

When things do start 'cracking' over here we will no doubt receive a great increase in the number of U.R.'s.

Mr. Entage was to give us figures, and would you, Mr. Fossey, ask him to give us these figures and also the experience of the R.A.F. If at all possible we would like to get samples of the forms and charts that R.A.F. is using in order that we may take a page from their book of experience.

Mr. Brauer:

Sixty or seventy-five per cent of the engines coming in at Burtonwood are from the R.A.F. At 250 hours for fighters and 360 hours for bombers they pull their engines for 'time' checking, but aside from these cases the situation with R.A.F. is about the same as for U.S.

Col. White:

Some sort of questionnaire may help us to get the ideas and recommendations from the Engineering Officers.

Major Taylor:

They are much closer to the troubles than anyone else.

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Col. White:

Other phases of troubles that we don't always get on U.R.'s would then be available to us.

Mr. Brauer:

The same answer is always given to me on this question and that is, "As long as the engine operates on the aircraft and isn't requiring change there isn't anything we can do about it; but as soon as they fail - replace them".

Col. White:

What do you think about bringing all the Group engineering officers together to get a complete picture?

Capt. Stogner:

I understood we would have some here today.

Major Taylor:

Let's request this from the Eighth Air Force official headquarters. I'll make the attempt. A Group Engineering Officer from each of the three Commands would be a good representation.

Col. White:

I still think that surveys would have to be made in questionnaire form. Major Taylor and I will arrange a statistical analysis to be sent around to all of you and to the members of the various Commands to see if it will serve their needs. The U.R.'s are difficult to handle when you want to get the figures quickly. We have to act on our own over here for the figures are such a long time in coming otherwise.

Mr. Jahnke:

We have been some sixty days since the first meeting on engine failures. Have we put into effect any of these suggestions? Could we put into effect some of today's suggestions on turbos as a trial?

Col. White:

It was my thought to have a group here so that we will know and appreciate the various problems that occur. I have benefited from these discussions and hope to get a lot more out of them. At some time in the future after we get the analyses of statistical data then the people back home and over here will listen to us.

Mr. Jahnke:

But have we been able to put any of our ideas into effect, say, with Capt. Stogner?

Capt. Stogner:

No. I have not incorporated any of the previous suggestions, but I will undertake to try the two suggestions made this morning, namely the addition of flame dampers on the outer engines and putting more load on the inboard engines. But you must remember that you can't go along with the pilot. He does exactly as he wants to in the air.

Mr. Allan:

In the R.A.F. we get the pilot, the engineer and the other interested parties together and talk over the situation and make the final decisions.

Mr. Jahnke:

You have to realize that if you need extra power in an emergency you can take it, but you can't object if your engine later goes out completely.

Mr. Brauer:

Many U.R.'s don't come in because the engines have been overboosted.

Col. White:

At least we are laying the foundation and when we get the

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Capt. Stogner: I'll try these suggestions. We'll try anything that isn't dangerous and that will help us.

Col. White: I think it is worth while and healthy to keep this Group operating so that we will have a Group that is conversant with existing problems, and better able to handle new problems when things develop in the future.

Mr. Graham: We seem to be discussing the same aircraft, the B-17, all the time.

Col. White: Of course the greater part of U.R.'s are on B-17's, which is quite natural due to their greater numbers over here. However, we will discuss any of the other models you are interested in.

Mr. Thompson: From a theoretical standpoint the B-24 isn't an ideal installation, but doesn't give us much trouble, while the B-17, which is technically an ideal installation, gives us more trouble on the average.

Col. White: Before our next meeting on the 2nd. June, could you, Mr. Thompson, give us the report from Capt. Kanykowski, who is trying your recommendations in his own squadron?

Mr. Thompson: I will have that for the next meeting.

Mr. Tresillian: Can Capt. Stogner tell us whether inboard or outboard engines require the most replacement.

Capt. Stogner: Out of 65 engines 34 inboard and 31 outboard - on the superchargers the ratio is definitely on outboards. Most of them fly by setting their engines with wide open throttle, setting the turbo at 40 inches and then setting the throttle back four or five inches at 27,000 feet.

Mr. Thompson: The question of lag is a very debatable point. There is a lag between the inboard and outboard superchargers from, perhaps, $2\frac{1}{8}$ to 3 seconds.

Capt. Stogner: This is due to two things. When you cut the engine back the exhaust decreases and takes longer to build back up. Also, the extra length of connections and controls make some difference.

Major Taylor: Wouldn't it be a good idea to have the forms changed to show the actual time of overboost?

Col. White: Yes, it would.

The meeting ended at 12.55 and the next meeting was set for 10.00. Wednesday, June 2nd at the offices of the Air Technical Section, Duke St.

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MINUTES OF MEETING HELD AT

AIR TECHNICAL SECTION, STONRA

5 May 1943.

PRESENT: Lt. Colonel R.S. White Power Plant Section, A.T.S. - Chairman
 Major C.M. Taylor M. & R. Division, VIII A.F.S.C.
 Captain S.T. Stogner Engineering Officer, 91st Bombardment
 Captain Butzel A-1, Eighth Air Force.
 Mr. A.A. Alden Allison Engines, M.A.P.
 Mr. Bird Curtiss Wright Corp. (rep.)
 Mr. Bruce M.A.P., R&W Engines.
 Mr. Brauer Curtiss Wright Corp. (rep.)
 Mr. B.M. Casey Wright Engines, M.A.P.
 Mr. M. Graham Pratt & Whitney (rep.).
 Mr. Johnke Allison (rep.)
 Mr. Tresilian Air Technical Section.
 Mr. Thompson General Electric (rep.)

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But how can you check your regulators on the ground when you get some 46 inches on the ground to begin with after installing this additional tailpipe?

Mr. Thompson:

You throttle back the engine while on the ground and then check your regulators before opening up to full throttle. This new addition is called the flame suppressor attachment, but the primary use for the thing has rather given way to its more important function as an aid to the supercharger. When between 26 and 30 thousand feet the wastegate lever, operating the turbo is in a very sensitive range. Closer to the ground you have to move your control in the cockpit through a comparative large range to effect changes in regulation, but the higher you go the less distance your control must travel to effect the desired changes. By the addition of this tailpipe you operate the wastegate at 20-26 thousand feet at the same control position as you normally would at from 26 to 30 thousand feet.

Col. White:

Do you go around to these stations for educational purposes?

Mr. Thompson:

Yes. I try to see them all at least every six weeks.

Col. White:

It seems to me that the pilots should have a chance to meet with you when you make these contacts. Major Taylor, from U.R. data most of the failures are from bucket stretching; isn't that right?

Capt. Stogner:

Yes. Most of the troubles are from bucket stretching and cracking.

Mr. Thompson:

The pilot would never know if only one bucket was missing. Naturally it isn't advisable to keep operating with one bucket gone, but numerous aircraft return from operations successfully and then find that one bucket has gone out.

Major Taylor:

While you are on that subject, why do you have overspeeding of the turbo when the wastegate is closed?

Mr. Thompson:

If you put your hand over the intake of your vacuum cleaner you back it up to excessive speed because you have cut off the weight of air. Leaks would also cause overspeeding if you have leaks in the system.

Maj. Taylor:

What is the best method of testing for leaks?

Mr. Thompson:

Smoke tests are the best means of locating or detecting leaks. Visual inspection and actual operation are the other two ways. In the B-24 most pilots fly on turbo. On B-58 we had a lot of trouble at first (32 had to be replaced), but that has been ironed out for we have educated the pilots not to operate on turbo. Of course, it's a bit difficult to operate a fighter and adjust the turbo simultaneously. The regulator failures were overcome by educating the ground crews as to what to do. When we get the automatic regulator they will get just so much and no more. That will be a mechanical control and will not be adjustable. There will be a device whereby you break a seal, but 21,300 revs. will be tops, however.

Col. White:

For your reference, gentlemen, Technical Order 01-1-72 refers to the break-through seal device and Technical Order 03-10HA-5 shows the

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boost control.

Mr. Jahnke:

Have you any information on P-38 operation of turbo?

Mr. Thompson:

They are having bucket failures and it is just due to overspeeding. I might tell you that G.E. has developed a steel that will increase the speed up to 27,000 revs. a minute. It has been suggested that we get it over here for use on the outboard engines only. This may lead to a lot of dissension, however. The bucket is cast and not stamped - these samples are pressure die-cast and you can't tell them from the forged ones. (Samples distributed).

Major Taylor:

If you give them a supercharger to turn over 8,000 more r.p.m.'s won't that mean more engines out.

Mr. Thompson:

Yes, it will.

Col. White:

Engines are always operating on the verge of trouble and you can't get away from it. But that represents progress and the price we pay.

Mr. Trasilian:

Have you ever tried operating the turbo without the rims on the bucket? It would save about 10% in weight of the blade.

Mr. Thompson:

We have, but you lose a great deal through leakage and also the rim stops blade vibration.

Col. White:

Have you experienced any lubrication failures?

Mr. Thompson:

In the two years I have been over here we have had only two cases of lubrication failure.

Capt. Stogner:

Do you still use engine oil in the G.E. turbo?

Mr. Thompson:

Yes, we do. We have never had a bearing failure on a P-34 and only two on P-17's. We have had cases of suspected fires in the turbo, but it was only afterburning and these could have been remedied by leaning up on the mixture. We have taken pliers, screwdrivers and bits of safety screens out of the intake duct, also a variety of pieces of planes themselves. To impress on the pilots the seriousness of correct supercharger operation I take around with me a wheel that has been cracked to show them what can happen.

Capt. Stogner:

I think the Engineering Officers realize what is happening, but it is the pilots themselves you have to sell.

Mr. Thompson:

In a station composed of 90 flying personnel who had been having trouble with the turbo because they didn't know how to handle it or what they were handling I conducted educational courses and they have had little or no trouble since.

Capt. Stogner:

But you have to sell our pilots on flying with turbo control.

Mr. Thompson:

What is the proportion of turbo failures to engine failures? Or, let us say, turbo changes to engine changes.

Capt. Stogner:

I don't have those figures.

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Col. White:

I'd say about 30 to 50% as many turbo changes as there are engine changes.

Mr. Thompson:

First of all, we regard "failures" as those cases in which the turbo won't work.

Capt. Stogner:

We regard failures as any case in which we have to change the turbo. I would say that about 50%, or about one-half as many "failures" are had with the turbo as with engines. If you give them a supercharger control that will give them as much power as the throttle then they'll use it to the limit.

Col. White:

I think education is the principal thing in this case, as in any other situation.

Mr. Brauer:

Does that added boost save many ships?

Mr. Trevelian:

Not only do we not know how many ships are saved, but we also do not know how many ships are lost by excess use of boost.

Mr. Thompson:

Don't you think that the failure of only the turbo is the lesser of two evils?

Mr. Brauer:

Yes, I do. It's easier to replace turbos.

Col. White:

I think we should go on to the second item on the Agenda and hear from the Engine Representative from Burtonwood.

Mr. Brauer:

I have some figures here obtained with the assistance of Mr. Bird, our representative at Burtonwood. I searched through the inspection records of 50 type 1620 engines at Burtonwood on which they had issued U.R. reports and of the mechanical failures, 18% - where no cause was traceable - constituted internal failures undetectable through 100-hour inspection. This group included valve washer failures. Sixty-eight per cent are due to piston rings, valve burning, etc.. 20% of this group had nothing wrong. Twelve-per cent were shot through by shell and flak and are not actual U.R. causes. These are engines that have been overhauled and the inspection completed. There are a small number of cylinders on hand (200 odd) and every effort is being made to remedy this situation.

Capt. Stogner:

How many engines do these figures cover?

Mr. Brauer:

Fifty, but of course, they had more to be overhauled and on which the inspection had not been completed.

Col. White:

I suppose any cylinder head breakage had been taken care of before the engines had ever reached Burtonwood? How is the bearing situation?

Mr. Brauer:

Yes, there were only two cracked cylinders heads and two bearing failures on this list. Valves were the most serious. The time lag is about three months between the time the engine was pulled and the time the inspection was completed.

Col. White:

It is troublesome, but the only thing we can do is trace the

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causes as soon as possible. We may only be able to analyze 20% to 30% of the troubles, but it is decidedly a benefit, and will give us the trend.

Mr. Brauer:

Would it be possible when the engine is pulled to make the inspection on the outside of the cylinders so that good cylinders can be kept at the stations as replacements on the engines?

Capt. Stogner:

In many cases the reduction gears are out and we can't check the compression. We don't want a new cylinder anyway. It takes just as long (7 to 8 hours) to run a new cylinder in as it does to run in a new engine.

Mr. Brauer:

A lot of cylinders are being robbed because of this.

Mr. Brasilian:

My suggestion would be that if the Stations do not intend to use the new spare cylinders then someone from Burtonwood should go along to the groups and perhaps locate a number of new spare cylinders that will never be used for subsequent utilization at Burtonwood.

Capt. Stogner:

A new run-in procedure was tried in the States, but 130 engines in one group had to be changed because of it. One B-17 ran only four hours.

Mr. Thompson:

Is it not the R.A.F. policy to change spark plugs when the engine has been overspeeded?

Mr. Possey:

Yes. We change spark plugs and also thoroughly inspect the engine.

Mr. Jahnke:

It is almost as difficult to get spark plugs as it is to get engines. We have a report pending on all the engines that have been to Burtonwood and will submit it in the near future. Particular stress is being placed on detonation. About four cases of detonation and three cases of burnt valves have been discovered so far. We are going to keep a running record on these engines at Burtonwood.

Mr. Graham:

I have been unable to get complete figures, as yet, from Burtonwood, but I have received a fair report from the Groups in the field. My information is in the making now and I'll get the figures to you as soon as possible.

Col. White:

When things do start 'cracking' over here we will no doubt receive a great increase in the number of U.R.'s.

Mr. Entage was to give us figures, and would you, Mr. Possey, ~~ask~~ ask him to give us these figures and also the experience of the R.A.F. If at all possible we would like to get samples of the forms and charts that R.A.F. is using in order that we may take a page from their book of experience.

Mr. Brauer:

Sixty or seventy-five per cent of the engines coming in at Burtonwood are from the R.A.F. At 250 hours for fighters and 360 hours for bombers they pull their engines for 'time' checking, but aside from these cases the situation with R.A.F. is about the same as for U.S.

Col. White:

Some sort of questionnaire may help us to get the ideas and recommendations from the Engineering Officers.

Major Taylor:

They are much closer to the troubles than anyone else.

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Col. White:

Other phases of troubles that we don't always get on U.R.'s would then be available to us.

Mr. Brauer:

The same answer is always given to me on this question and that is, "As long as the engine operates on the aircraft and isn't requiring change there isn't anything we can do about it: but as soon as they fail - replace them".

Col. White:

What do you think about bringing all the Group engineering officers together to get a complete picture?

Capt. Stogner:

I understood we would have some here today.

Major Taylor:

Let's request this from the Eighth Air Force official headquarters. I'll make the attempt. A Group Engineering Officer from each of the three Commands would be a good representation.

Col. White:

I still think that surveys would have to be made in questionnaire form. Major Taylor and I will arrange a statistical analysis to be sent around to all of you and to the members of the various Commands to see if it will serve their needs. The U.R.'s are difficult to handle when you want to get the figures quickly. We have to act on our own over here for the figures are such a long time in coming otherwise.

Mr. Jahnke:

We have been some sixty days since the first meeting on engine failures. Have we put into effect any of these suggestions? Could we put into effect some of today's suggestions on turbos as a trial?

Col. White:

It was my thought to have a group here so that we will know and appreciate the various problems that occur. I have benefited from these discussions and hope to get a lot more out of them. At some time in the future after we get the analyses of statistical data then the people back home and over here will listen to us.

Mr. Jahnke:

But have we been able to put any of our ideas into effect, say, with Capt. Stogner?

Capt. Stogner:

No. I have not incorporated any of the previous suggestions, but I will undertake to try the two suggestions made this morning, namely the addition of flame dampers on the outer engines and putting more load on the inboard engines. But you must remember that you can't go along with the pilot. He does exactly as he wants to in the air.

Mr. Allan:

In the R.A.F. we get the pilot, the engineer and the other interested parties together and talk over the situation and make the final decisions.

Mr. Jahnke:

You have to realize that if you need extra power in an emergency you can take it, but you can't object if your engine later goes out completely.

Mr. Brauer:

Many U.R.'s don't come in because the engines have been overboosted.

Col. White:

At least we are laying the foundation and when we get the

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personnel over here we will then be able to accomplish more.

Capt. Stogner: I'll try these suggestions. We'll try anything that isn't dangerous and that will help us.

Col. White: I think it is worth while and healthy to keep this Group operating so that we will have a Group that is conversant with existing problems, and better able to handle new problems when things develop in the future.

Mr. Graham: We seem to be discussing the same aircraft, the B-17, all the time.

Col. White: Of course the greater part of U.R.'s are on B-17's, which is quite natural due to their greater numbers over here. However, we will discuss any of the other models you are interested in.

Mr. Thompson: From a theoretical standpoint the B-24 isn't an ideal installation, but doesn't give us much trouble, while the B-17, which is technically an ideal installation, gives us more trouble on the average.

Col. White: Before our next meeting on the 2nd. June, would you, Mr. Thompson, give us the report from Capt. Kamykowski, who is trying your recommendations in his own squadron?

Mr. Thompson: I will have that for the next meeting.

Mr. Tresilian: Can Capt. Stogner tell us whether inboard or outboard engines require the most replacement.

Capt. Stogner: Out of 65 engines 34 inboard and 31 outboard - on the superchargers the ratio is definitely on outboards. Most of them fly by setting their engines with wide open throttle, setting the turbo at 40 inches and then setting the throttle back four or five inches at 27,000 feet.

Mr. Thompson: The question of lag is a very debatable point. There is a lag between the inboard and outboard superchargers from, perhaps, 2 1/2 to 3 seconds.

Capt. Stogner: This is due to two things. When you cut the engine back the exhaust decreases and takes longer to build back up. Also, the extra length of connections and controls make some difference.

Major Taylor: Wouldn't it be a good idea to have the forms changed to show the actual time of overboost?

Col. White: Yes, it would.

The meeting ended at 12.55 and the next meeting was set for 10.00, Wednesday, June 2nd at the offices of the Air Technical Section, Duke St.

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HEADQUARTERS
VIII AIR FORCE SERVICE COMMAND
APO 633

R-K-15

In reply refer
to: 337.91

AAF-586,
1 July, 1943.

SUBJECT: Inspection of Turbo-Superchargers.

TO : Commanding General, Air Service Command, Patterson Field, Fairfield,
Ohio, (Attention: ASCESS).

1. Reference is made to letter, your headquarters, dated 18 May 1943,
subject: Unsatisfactory Report No. 43-4957 MS re: Unsatisfactory Condition of
Turbo-superchargers.

2. An instructional memorandum has been prepared at this headquarters
and distributed for the guidance and assistance of maintenance personnel in-
specting the type "B" Superchargers. A copy of this memorandum is attached.

3. In the preparation of this memorandum it was deemed desirable that
some definite measurement be established to represent a maximum permissible
bucket wheel stretch. The observations of Factory Representatives and the
experience of various engineering officers in this theater indicate that the
operation of superchargers with buckets stretched more than .010 inches re-
sults in early failure when the engine is again overspeeded. Therefore, the
measurement of .010 inches was established as a criterion, for the guidance
of personnel inspecting turbo-superchargers.

4. Superchargers referred to in Unsatisfactory Report which was the
subject of your letter of 18 May 1943 were overhauled at depots as indicated
below:-

Supercharger, Serial Number 10060 at AAF-590
" " " 98702 LY at AAF-597.

For the Commanding General:

V. H. JACOBS,
Lt. Col. A.G.D.,
Asst. Adjutant General

A. G. COPY
PREPARED BY

NAME

Capt. A.C.

CO-ORDINATED WITH

2 JUL 1943 Encl: Maintenance Memo #70-51.

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R-P-11.

Hq. VIII AFSC, Maintenance Division, AAF-506, APO-633, 27 September, 1943.

TO: Commanding Officer, Base Air Depot Area, AAF-590, APO-635.

Re: paragraph 4 of basic communication, instructions in attached letter are to be followed pertaining to inspection of C-21 Supercharger bearings.

JOHN S. GRIFFIN,
Colonel, Air Corps,
Chief of Division.

Incls:

Incl. 1 - N/C.

Incl. 2 - Basic ltr to B.A.D.A.
dated 23 Sept., 1943.

*Basic: Ltr. BADA. 22 Sept. 43;
Sub: Inspection of Supercharger
Bearings, P-47.*

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HEADQUARTERS
BAND AIR GROUP 1000
Office of the Commanding Officer
APO 635 U. S. Army

1-15

AAP 590
22 September 1943

452.13

SUBJECT: Inspection of Supercharger Bearings, P-47.

TO: Commanding General, VIII AFSG, AAP 506, APO 633, U.S. Army

1. Your attention is invited to attached letter received from Lockheed Aircraft Corporation concerning removal of turbo-supercharger bearings from P-47 type aircraft.

2. This Headquarters in letter date of 31 August recommended that this requirement be removed from subject aircraft. Favorable consideration was not received from your Headquarters.

3. Consideration is requested and recommended for reasons stated in attached letter. It is desired to reiterate the following:

a. Of a total of 29 man hours at present required to place a P-47 operational, 50 man hours are consumed in complying with subject modification.

b. Out of a total of 16 bearings inspected at Space, only one bearing showed evidence of overheating.

c. It is desired to point out too, that failure of subject bearings would not endanger the safety of flight as sufficient boost is available in the engine supercharger for medium altitude flight.

d. In view of the above mentioned facts, it is strongly recommended that the inspection of supercharger bearings on P-47 aircraft be dispensed with.

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Incl:
1 ltr LAC 20 September
as indicated

JOSEPH T. MORRIS
Colonel, Air Corps
Commanding

23 SEP 1943

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452.1 P-47

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333.1

Deficiencies in Turbo-Supercharger operations - cont'd.

5. Pending the attainment of the above ideal, personnel of the tactical Units should be made fully aware of the powers and limitations of the equipment they operate and adhere to instructions which are clearly laid down in pertinent Technical Orders.

For the Commanding General:

L. W. MILLER
Brigadier General, USA.
Chief of Staff.

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HEADQUARTERS EIGHTH AIR FORCE, APO 633, ETOUSA. To: The Commanding General.
VIII Air Force Service Command APO 633, ETOUSA.

1. Attention is invited to the deficiency reported by the Inspector General under paragraph 1a, basic, and to the differences in technique of operation of controls reported therein.

2. The Commanding General approves the recommendation noted in paragraph 2, basic, and desires that an immediate investigation and report in the manner indicated be conducted and reported to this headquarters.

By command of Major General SPAATZ:

(sgnd) ASA N. DUNCAN,
Brigadier General, USA,
Chief of Staff.

2nd Ind.

1-3-3

333.

Headquarters, VIII Air Force Service Command, APO 633, 3rd October 1942.
To: Commanding General, Eighth Air Force, APO 633, ETOUSA.

1. Reference Paragraph 1a., basic communication, the manipulation of turbo regulator controls frequently during engine warm-up, is recommended as a means for circulating warm oil to the regulators in order to prevent runaway turbos during take-off.

2. The practice of regulating manifold pressure by means of manipulation of propeller governor controls is not recommended due to high cylinder head pressures which may be caused by this operation.

3. It has come to the attention of this Headquarters that the British Thomson Houston Corporation of Rugby, England, has developed a regulator control for B.17 airplanes, combining the throttle and regulator control operation in one lever, with the addition of a governor to prevent turbo over-speeding. This installation is at present under investigation and, if approved, steps will be taken to install same on B-17 aircraft of the Eighth Air Force.

4. The problem of correct supercharger regulation has been under development for the past year by agencies of the Material Command, General Electric Corporation and the R.A.F., with a view towards combining in one lever, the operation of the throttle, supercharger regulator, mixture control and propeller governor. This is the ideal solution which has not yet been obtained for production or tactical usage. Immediately such an installation becomes available this Headquarters will take steps for the supply of supercharger equipped aircraft of this Air Force.

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HEADQUARTERS EIGHTH AIR FORCE
Office of the Inspector General
ETOUSA

IG 333.1-Bomb.Cmd.

18th September 1942

SUBJECT: Action-letter, I.G.D., Deficiencies in Turbo-Supercharger
Operations.

TO: The Commanding General, Eighth Air Force, APO 887, ETOUSA

1. DEFICIENCIES.

1. The following deficiencies were noted during the course of a special inspection of the Bomber Command, September 6-13, 1942, and are reported under the provisions of paragraph 11a (2), AR 20-10, dated July 22, 1942.

a. Examination of turbo buckets disclosed that ruptures have been caused by overspeeding of the supercharger. There is a difference of opinion among pilots and engineering officers as to the best means to overcome this difficulty. Some recommend that a form of manual control between the throttle and turbo controls is necessary; others maintain that pilots can be indoctrinated with approved methods of turbo-supercharger operation to overcome the difficulty, by (1) manipulating the turbo-supercharger quadrants frequently during engine warmup, and (2) by locking throttles wide open when reaching 15,000 feet and thereafter regulate manifold pressure by manipulation of propeller governors.

11. RECOMMENDATIONS.

2. That technical experts in this theater be directed to make an immediate investigation of the difficulties and provide the best solution to the problem.

(sgnd) HAROLD A. MCGINNIS.
Colonel, I.G.D.,
Inspector General.

EXHIBIT No.9. to Rpr/SpInsp
Bomb.Cmd., 9/6-13/42

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452.131
 File 452.1-P-47 3rd Ind.
 Hq, VIII AFSC, Maintenance Div., AAF-586, APO-633, 3 January 1944.

To: Commanding Officer, Eighth AF Base Air Depot Area, AAF-524, APO-635.

1. Authorization for the modification of C-1 Turbo-Superchargers to C-21 Turbo-Superchargers is not approved by this Headquarters.
2. Information from Fighter Command indicates that they will accept either C-1 or C-21 Turbo-Superchargers for use in the appropriate aircraft. It is not considered by Fighter Command that there is any appreciable difference between C-1 and C-21 Turbo-Superchargers, hence, it is not deemed advisable to convert C-1's to C-21's.

JOHN S. GRIFFITH.
 Colonel, Air Corps,
 Chief of Division.

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Office of the Chief Aero Repair Div.

27 Dec 43.

Sub. Superchargers for P. 47 aircraft.

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Headquarters, 1st Base Air Depot, AAF 520, APO 635. 28 December 1943.

TO: Commanding Officer, Eighth Air Force Base Air Depot Area, AAF 524, APO 635.

1. The basic communication is forwarded for your information.
2. Inasmuch as the overhaul and repair of superchargers has been allocated to AAF Station 597, it is recommended that consideration be given to accomplishing the conversion of C-1 superchargers to C-21 superchargers at AAF 597.

For the Commanding Officer:

/s/ D. S. SCHER
For WILLIAM H. REICHD
Major AG
Chief, Maintenance Division.

452.131
X452.1-P-47 2nd Ind. R-0/2
HQ, Eighth AFBADA, AAF 524, APO 635, U. S. Army, 30 December 1943.

TO: Commanding General, VIII AFSC, AAF 586, APO 633, U. S. Army.
ATTN: Maintenance Division.

1. It is requested that the basic communication be brought to the attention of the General Electric Representative in U.K.
2. It is requested that this Headquarters be advised of desired action.

For the Commanding Officer:

V. H. JACOBS
Lt. Col., AGD
Executive

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OFFICE OF THE CHIEF
ARMY AIRCRAFT DIVISION
101 MICHIGAN STREET
WASHINGTON, D.C. 20310

408.101
101 MICHIGAN STREET

1-11-61
27 December, 1961.

SUBJECT: C-47 aircraft for 1-11 aircraft.

TO: Chief, Materiel Division, 101 MICHIGAN STREET, WASHINGTON, D.C.

1. In order to secure C-47 aircraft for P-47-6-12 to P-47-10-12 aircraft, it came to the attention of Planning and Planning that 234 ac. C-47 aircraft were available throughout, and not being issued, as no more are required for this type.

2. It is understood from Mr. Charles Barnes, Langford Lodge, Extension 209, that these aircraft can be modified to C-47 type if flash welded heavy point bucket shape are made available.

3. It is recommended that investigation of above be made and action taken to modify a portion of the C-47 aircraft available at Gettysburg, as it is found very difficult to secure C-47 type.

4. Mr. Macpherson, General Electric Representative should be able to furnish confirmation of possibility and feasibility of modification.

MAJOR F. McFARLANE
Major, 101
Chief, Aero Repair Div.

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