new procedure was devised and the new layout, shown in Exhibit E, was formulated. It was expected to be in full operation by August 1, 1943.

The new procedure provides for an assembly line type of overhaul. Wings are removed at Station 0 and the hull is then moved to Hull Station No. 1, which is indicated on Exhibit E by heavy duel lines. Engines, leading edges, and trailing edges of the wings are removed at Wing Station No. 1 and disassembly of the wings is completed at Station No. 2. Stations Nos. 3, 4, 5, and 6 repair the metal structure and the integral gas tanks, and Stations No. 7, 8, 9, and 10 reassemble all the overhauled wing parts. The completed wing then goes to Station No. 11 where it is reattached to the hull and the surfaces are rigged for flight. While the wings are moving through this process, the hull proper is undergoing similar treatment. At Hull Stations Nos. 1 and 2, it is disassembled, and all necessary changes are incorporated. The metal structure is repaired at Stations Nos. 3, 4, 5, and 6. Overhauled components are reassembled at Stations Nos. 7, 8, 9, and 10, and the hull is moved to Station No. 11, for attachment of the wing and completion of inspection 27/. The overhauled aircraft is then ready for ground and flight tests.

We believe that the assembly-line procedure prescribed by the new layout represents a substantial improvement over the old system which was in effect when we inspected the Department. As the AAR

27/ The layout provides space for two assembled aircraft for use in the event that the test flight reveals difficulties which require that the aircraft re-enter the division for additional work.

Officer pointed out, it has the following advantages: (1) it provides definite work positions for personnel; (2) stabilizes the position of equipment and eliminates the occasion for moving it to various positions on the floor; (3) establishes permanent points to which parts can be delivered; (4) the definite movement of the hull and wing provides incentive to workers to finish the job on time; and (5) the work follows a pattern and can be more efficiently performed and checked.

In addition, it is expected that a substantial amount of time will be saved as a result of removing and handling the wing as a separate unit. The Department estimates that approximately 150 man-hours will be saved in removing and reinstalling leading and trailing edges alone. Removal of the wing will make handling of the hull much less awkward. Moreover, it should now be possible to utilize many more women employees because work will be performed at floor level and it will be unnecessary to move heavy equipment about on work stands.

Obviously, there was a real need for changing the procedure for interim overhauls and it caused us some concern that some system similar to the one recently divised had not been installed some time ago.

8. Management Policies and Practices.

(a) Dissemination of Technical Information.

The Engineering Section is charged with dissemination of technical information and advises shops with respect to methods

of repair, prepares technical instructions for their use, authorizes substitution of materials, and prepares necessary drawings and blueprints.

Its work is directed by the Chief Engineer, with the assistance of the Substitutions Officer, the Chief Draftsman and the Liaison Engineer. However, the Liaison Engineer was not fully occupied and stated that little work, if any, had been delegated to him by the Chief Engineer. Most of his work was brought directly to him by shop personnel. Yet, the Chief Engineer informed us that he needed one or two additional engineers. With aeronautical engineers practically unobtainable, it seems the services of the Liaison Engineer should be fully utilized before additional personnel is procured.

Although it appears that the Chief Engineer generally keeps the shops currently informed with respect to technical changes and cooperates with them in their problems, shop supervisors state that he frequently is dilatory in advising them regarding methods of repair and utilization of parts. They also say that the Chief Engineer is somewhat reluctant to reduce his decisions to writing. Since inspectors will not accept oral opinions, any delay in reducing decisions to writing necessarily retards production. It appears that the Chief Engineer can readily eliminate these difficulties by accelerating his decisions and by promptly reducing them to writing.

(b) Shop Stores

The Department stocks parts which most frequently need replacement in its shop stores so that such parts will be easily accessible to workmen without forwarding a multitude of individual requests to the Supply Department. A maximum of 60 days' supply is maintained in stores and replenishment orders are issued to the Supply Department when the supply is reduced to the estimated requirements for 30 days.

The size of the stock of a particular part is ordinarily determined with the recommendation of the shop which uses it, and after an investigation to establish the necessity for maintaining the stock.

It is contemplated that the catalogue of shop stores will be further expanded whenever the occasion presents itself, and the necessity for such arises. The records disclose that stocks have been progressively augumented since January, 1943. On that date, the Production Superintendent ordered the preparation of lists of the parts which have a high percentage of replacement on five types of aircraft with a view to stocking these parts. Some of these lists were prepared, but there was no substantial increase in the number and character of the parts in shop stores. Apparently, it was found that present stores were adequate and it was determined to increase the stores gradually on some other basis. In view of the great savings in time and paper work afforded by well stocked stores, it is a matter which merits almost constant attention to insure maximum results.

(c) Salvage Activities

Because of critical shortages of many materials A&R has established a Salvage Board, under the supervision of the Executive Assistant, which directs its energies to devising methods of salvage through re-use and repair of aircraft parts. The Board only meets once or twice a month and, consequently, critical parts which have been rejected often lay around in shops for several weeks before the Salvage Board decides what to do with them. We are inclined to the belief that the Board could profitably establish a definite schedule for more frequent meetings so that these materials will no longer accumulate as they do at the present time.

(d) Spoilage, Waste, and Similar Practices

There has been a substantial amount of spoilage and waste in A&R. Although this condition is attributable, in part, to the inexperience of personnel, much of it can be blamed upon inadequate supervision and poor management. The following examples, although somewhat extreme, will serve to illustrate our point:

(1) SNC Tubing. A substantial number of SNC aircraft was delivered to the Station in 1941 for the training program, but use of them for this purpose was discontinued in early 1942 and the transfer of them elsewhere was commenced. In all, 154 SNC aircraft were so transferred. There was only one SNC when we were there and it had crashed. 28/

A stock of SNC replacement parts, including new SNC fuel, oil,

28/ The Station is awaiting action of the Bureau of Aeronautics with respect to the "striking" of this airplane. It will then be removed from the Bureau records and all usable parts will be salvaged.

hydraulic, fire, and other lines, was built up for overhaul and repair of these airplanes, but the lines were not transferred to the other activities with them. These lines were especially manufactured for SNC's of 52S aluminum - a very critical material.

Although it appears that this tubing would nominally have been shipped with the other replacement parts to activities utilizing the SNCs, it was retained at the Station and A&R requisitioned all of it from Supply on the dates and in the amounts indicated below:

Date of Requisition	Number of SNC Aircraft at Station	Value of Tubing
1943		
February 23,	7	$3,730.60
March 11,	2	6,390.24
April 7,	1	2,608.08
Total		$12,728.92

Since all the SNC aircraft on the Station in this period were soon to be transferred, these requisitions were made for the overhaul and repair of SNJs, SNVs, and other aircraft then being utilized in the training program. The fuel and other lines of these aircraft are quite different, so that it was readily apparent that a great deal of waste would necessarily occur in converting the SNC lines. Nevertheless, A&R determined to utilize the SNC tubing because an adequate supply of tubing could not be obtained and repair and overhaul would have been delayed unless the SNC tubing was used. The Department had dispatched an urgent wire to the Naval Aircraft Factory, Philadelphia, Pennsylvania, on January 15, 1943, requesting shipment of suitable tubing. After an exchange of telegrams,

the Naval Aircraft Factory asked the Supply Depot in Oakland, California, to ship a substantial amount of tubing to Corpus Christi. It does not appear whether any of this tubing ordered January 15, 1943, had arrived on February 20, 1943, when a second order for additional types of tubing was placed with the Naval Aircraft Factory. Three days later, however, the first requisition for SNC tubing was forwarded to the Supply Department. 29/ Thereafter, on March 11 and April 7, 1943, additional requisitions for the remaining SNC tubing were sent to Supply.

Regulations regarding utilization of salvaged tubing were issued by the Engineering Section in an order dated March 20, 1943, which, provided, in part, as follows:

> 2. Salvaged and reworked tubing is authorized for use on the following systems: fuel vent and drain; fire extinguisher; airspeed pressure and static; manifold pressure; vacuum; purging; anti-icing; and electrical conduit.
>
> * * *
>
> 5. Pressure and return lines of fuel, oil and hydraulic systems shall be replaced with new tubing of the same diameter and wall. Any deviation in wall thickness must be specifically approved by the Engineering Section.

The shop supervisors estimate that they have been able to utilize about 10% of the SNC tubing for all authorized purposes in other

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29/ The Naval Aircraft Factory asked AAR for a reply to a telegraphic inquiry regarding the February 20 order when none was received after eight days and further communications were exchanged as late as March 7.

types of aircraft. 30/ Thus, approximately 90% of the tubing was thrown in the scrap box although fittings were salvaged for use with other tubing. There was additional waste which was incidental to the use of this SNC tubing in that the Tubing Shop also cut up and scrapped a number of templates for making SNC lines when it was ordered to use the tubing on other aircraft. Shortly thereafter, A&R received two orders for SNC lines, by virtue of the fact that it had been designated as a manufacturer of SNC tubing, and it was necessary to make a complete set of new templates so that this tubing could be manufactured. The Department was thus placed in the rather anomalous position of having to re-manufacture templates which it had recently scrapped.

It is difficult to argue with the decision of A&R to use the SNC tubing if it actually would have been impossible otherwise to keep airplanes in service, but there seems to be no excuse for continuing to waste these materials after other tubing was received. Although we have no record of the quantity or value of SNC tubing

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30/ The Tubing Shop supervisors stated that they vigorously objected to cutting up SNC tubing for use on other aircraft. When it was first delivered to the Tubing Shop, the snapper in charge was told to salvage all fittings, use whatever tubing he could, and then discard the remainder, but he objected on the basis that this tubing should have been transferred with the SNC aircraft for which it was made. He and his supervisor discussed the matter with the foreman and division superintendent of the Machine and Metals Division and were told that "orders were orders". However, it was not actually used for about two weeks when the snapper again discussed the matter with the Senior Civilian Supervisor. When the second requisition was filled by Supply, the shop supervisor stated his objection again and, with his immediate supervisor, contacted the Executive Assistant, who said that use of the tubing was necessary and expressed the opinion that the Navy would stop utilizing SNC aircraft. Thereafter, the second supply of SNC tubing was utilized as fully as possible and the remainder was scrapped.

that was needlessly cut up, it appears that a substantial amount was involved. As of July 7, 1943, A&R had on hand 255 pieces or units of SNC tubing in A&R, valued at approximately $1,500, in addition to a complete set of 132 pieces which were used in manufacturing the templates. These units of SNC tubing should be forwarded immediately to activities where SNC's are used because, if it remains in A&R, only 10% of the tubing will be utilized. A&R should give particular attention to problems of this nature and take every conceivable step to prevent similar occurrences.

(2) Careless Damage to Aircraft Engines. There have been a number of instances of damage to engines in the Engine Test Shop of the Engine Overhaul Division [31/] because of indifferent management and careless workmanship.

On May 16, 1943, a Pratt and Whitney Type 985 engine was "burned up" in the A&R test cells when a piece of masking tape was inadvertently left over the inlet and outlet oil lines. The reduction of oil pressure was not noticed by the test-cell operator because the switch to the klaxon, which signals the existence of low pressure, had been pulled. These engines have a value of $8,000 to $10,000 and this one was damaged approximately 60 to 70 per cent. A&R had already spent 156 hours overhauling this engine when it burned, and it took another 150 man-hours to rebuild it.

On May 17, 1943, a Wright Aircraft Type R60-80 engine was seriously damaged soon after it was placed on the test stand because a knuckle

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31/ The Division Superintendent is a petroleum engineer, who was ordered to active duty in the Navy shortly after he received his degree in June, 1941.

pin installing tool was left in the gear section. This engine had to be disassembled and completely overhauled a second time.

On May 20, 1943, a Pratt and Whitney Type 985-3 engine had to be completely dismantled, reinspected, and reassembled after the test run had been completed because a rag had been left in the rear case of the engine. All parts of the engine were inspected for traces of the rag and then it was re-assembled.

On May 28, 1943, a Pratt and Whitney Type R985-3 engine was found to contain a cardboard piston identification tag while it was being tested. This necessitated the removal of all cylinders and the washing and cleaning of the oil lines, which operations required about 30 man-hours.

On May 28, 1943, another Pratt and Whitney Type 985 engine failed after its test run had been completed and it had been passed by the inspector. This failure was caused by a delay of forty-five minutes or an hour after the establishment of a siphon between the oil weight tank and the engine before commencing the usual white gasoline run which removes any lead deposits. During this interim, the siphon apparently failed to remain established, and consequently, a babbit bearing in the nose section froze in its shaft because of lack of oil. It was necessary, therefore, that the engine be sent through minor repair and re-tested. Again, in this instance, the test-cell operator had pulled the switch to the klaxon so that there was no warning of the oil pressure reduction.

On June 8, 1943, three ¼" nuts were found in the oil sump of a Pratt and Whitney Type R985-3 engine and, on June 9, 1943, a rag was found in another engine of the same type. Fortunately, the obstructions were located before any damage occurred.

On June 11, 1943, a Pratt and Whitney Type R985-8 engine was observed to be losing oil pressure on the test stand and examination disclosed that it contained a cardboard piston identification tag. This necessitated removal of all cylinders, cleaning the nose and rear sections, reassembling the engine, and placing it on the stand for a new run. These operations consumed about 30 man-hours.

On June 18, 1943, another piston identification tag was found in a Pratt and Whitney Type R985-3 engine. This engine also had to be cleaned and reassembled.

On July 6, 1943, a Pratt and Whitney type R1830-66 engine was run for about eight minutes without oil and this resulted in damage estimated at about $3,000. The test operator had failed to reopen an oil inlet valve which he had closed when he went into the test cell to stop a small oil leak in another connection. The switch to the klaxon had once more been pulled and the operator had neglected to watch the oil pressure gauge carefully.

The foregoing pattern of engine failures demonstrates, we think, that A&R must take immediate measures to prevent this wasteful and unnecessary damage to valuable equipment. Indeed, it has already delayed too long in view of this succession of engine failures from May 16 to July 6, 1943.

It should be pointed out, in passing, that the Intelligence Officer of the Center, whose primary function is prevention of sabotage, has permanently detailed one officer from his small staff to A&R because of the frequent recurrence of incidents such as those we have described. 32/ The damage to these engines was investigated carefully by this officer, and any negligence on the part of the supervisors or workmen impose an unnecessary burden on the Intelligence Office.

In an effort to minimize the time required to investigate damage attributable to negligence rather than sabotage, the Intelligence Officer made certain specific recommendations to the Commanding Officer of the Station with respect to the operation of the Engine Overhaul Division of the A&R Department. These recommendations were substantially as follows:

(1) Discontinuance of the use of masking tape to cover external engine openings and the utilization of plastic plates, which have been available in the Supply Department since May 15, 1943;

(2) Substitution of a buzzer or bell for the klaxon, which makes an irritating noise; and the elimination of any switch for turning off this buzzer or bell, or, the attachment of the warning device to the magneto switch so that it would always be on when the engine was running;

32/ The Intelligence Officer of the Center was formerly in the Federal Bureau of Investigation and appears to be well qualified for his present position. The officer assigned to A&R is also qualified for intelligence work and appears to be doing an excellent job.

(3) Inauguration of a system of checking off all the preliminary operations required before an engine is started on its test run so that each operator may check to ascertain whether some vital operation has been omitted;

(4) Attachment of a strong spring to the oil flow valve so that an operator will be required to close the valve manually during a test and the valve will open automatically when the pressure is released;

(5) Investigation of the establishment of siphons between the oil weight tank and the engine by competent engineers;

(6) Assignment of one helper to two test-cell operators, so that someone will always be available to watch the controls when it becomes necessary for the operator to go into the cell; and

(7) Mandatory compliance with a recent order eliminating the use of cardboard piston identification tags.

We concur in these recommendations. Moreover, it appears to us to be somewhat paradoxical that the occasion should ever arise for the formulation by the Intelligence Officer of such shop procedures and practices which should have been rather obviously necessary to the technical supervisors of the work.

(3) Negligent Workmanship on PBY Aircraft. On April 23, 1943, a PBY, which had been overhauled in A&R, was making a scheduled six-hour flight over the Gulf of Mexico when the crew observed that it was getting no gasoline from the starboard tank. Fortunately, there was time to return safely to the Naval Air Station. Investigation showed that the gasoline failure resulted from the carelessness of workmen in leaving a wooden plug in the nipple of the starboard sump of the main fuel line. In two inspections and three beach tests,

A&R and the Inspection and Survey Department [33] had not found the plug, and the PBY was turned over to the squadron in this condition. Had it not been for the vigilance of the crew, this negligent workmanship might well have caused the loss of the aircraft and its entire crew.

This matter was never officially called to the attention of the Intelligence Officer; he learned of its occurrence approximately twenty-eight days later at a social function. Such casual treatment of matters of this sort seems absolutely inexcusable. Had it actually been sabotage detection would have been rendered practically impossible after the passage of so much time. Immediate action should be taken to insure that similar occurrences will be reported immediately to the attention of the Intelligence Office.

The delayed investigation by the Intelligence Office revealed, among other things, that the starboard sump connection was supposed to have been made by two employees who were inexperienced and had been working only a few days in A&R, that the inspection door over the connection was replaced without a visual inspection, and that the inspector on the third beach test neither made the prescribed visual inspection which would have shown the plug in the sump nor checked the fuel selector valves which would have shown that the engine was receiving gasoline from the port tank alone.

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[33] Inspection of parts repaired in A&R is the function of the Inspection and Survey Department because it is felt that inspection by a separate department accords the inspectors more independence in making decisions.

The first two beach tests were made by one shift and the third test was made by another. It is not known why the aircraft failed to pass the first two tests because the check-off sheets of negative beach tests are destroyed instead of being kept for utilization by any succeeding shift. However, it does appear that an inspector and the snapper in charge of the engine installation crew during the first two tests argued about the proper method of checking fuel selector valves, but neither this dispute nor any other question relating to the fuel selector valves was called to the attention of the separate shift which made the third test. Moreover, it finally developed that the snapper in charge of the installation crew for the first two tests did not know how to check fuel systems and actually checked fuel selector valves in a manner that could not have disclosed that the starboard tank was obstructed.

While this matter appears to be attributable primarily to incompetence and carelessness of employees, it seems that some corrective measures should be adopted by AAR. It is evident, as suggested by the Intelligence Office, that, if new and inexperienced employees are to be assigned to important work, they should be carefully instructed and closely supervised. Detailed instructions with respect to the proper manner of checking fuel systems should be given to engine installation crews, inspectors should make the required visual inspections and not rely on the word of others, and adequate beach test records should be maintained.

preserved, and passed on to the succeeding shift whenever any difficulties appear.

(4) Failure to Perform Additional Work on Aircraft Returned by Flight Test. Civilian supervisors stated that the Flight Test Unit had returned airplanes to the shops for adjustments, when, in their opinion, no additional work was necessary. These supervisors apparently believe that these airplanes were returned primarily because the officers in Flight Test wanted to discredit them. On two or three occasions, they merely rolled the airplanes into the shops, did no additional work, and returned them to Flight Test a few days later without the consent or knowledge of any key administrative officials. According to these supervisors, the officers in Flight Test then told them they had done a "sweet job" and asked why they had not done that type of job in the first instance.

While the fact that some airplanes were accepted even though no additional work was done might be indicative that there was no great need for adjustments, the failure of these supervisors to inspect the aircraft thoroughly and to make the most minute adjustments requested by the Flight Test Unit must be strongly condemned.

Any change the test pilot desires should be made and the A&R Officer should take any action necessary to prevent recurrences of this practice. The Flight Test Unit should be required to list its objections to aircraft and should check to be insure that these corrections are made. It should be added also that the fact that there is no one in the management of A&R, whom the men respect and regard as unprejudiced and sympathetic, to advise them on problems probably aggravates situations of this sort.

(e) "Gunshaw". 24/

According to both naval officers and civilian supervisors, the practice of making or repairing items for personal use with government material and labor was quite prevalent prior to the reorganization of A&R. Among the items said to have been made were goose and duck decoys and rowboats. Also, furniture was re-upholstered and silverware was replated.

Notwithstanding its knowledge of the prevalence of this practice prior to the reorganization, the A&R Department did not issue a formal order with respect to it until March 29, 1943, and only then at the insistance of the Intelligence Officer. This order provides:

> 1. It has come to the attention of the Assembly and Repair Officer that some of the personnel are making articles for personal use out of Government material. In several cases, Federal Officers have found Government tools and material in the homes of Assembly and Repair personnel.
>
> 2. Civilian employees are not only subject to discharge for such criminal offenses but, in addition, are liable to prosecution under U. S. Statutes which provide for a maximum penalty of ten years in the penitentiary or a fine up to $10,000 or both. Enlisted men are subject to Court Martial and penalties invoked therein.
>
> 3. Any personnel who have carelessly or inadvertently taken Government property to their homes are advised to return it immediately.
>
> 4. Complaints concerning the above offenses received by this Office or by the Naval Intelligence Office will be referred to the Federal Bureau of Investigation.

24/ A term used in naval circles to denote the use of government time, equipment, or materials for purely personal purposes.

It will be noted that the language of the order makes specific references to the penalties for misuse of government time and materials by civilians and enlisted men but does not mention naval officers. The omission of any reference to officers is regarded as significant by the civilians in that it appears to them to establish different standards for civilians and officers. They are supported in this conclusion by their knowledge of evidence that officers have articles made for personal use and, hence, feel that the order should name officers as well as civilian and enlisted personnel.

The type of thing that annoys them is exemplified by two examples of "gunshaw" that occurred after the reorganization but prior to the issuance of this order. In the first case, a quartermaster had a set of bridle bits made with government material and labor. He was sharply reprimanded and reduced in rating to a first-class craftsman. In the second case, a number of "swivel-chair wings" were made for naval officers. These wings consisted of a replica of the Navy wings and had a swivel-chair emblazoned in the center. According to our information, they were presented as a joke to naval aviators who had been ordered to desk jobs. No disciplinary action whatsoever was taken with respect to this matter. Although these instances are distinguishable on the basis of humor alone, both involved misuse of government property and there should have been some similarity in the pattern of disciplinary action.

We understand that there has been practically no "gunshaw" since the issuance of this order. However, one matter arose after

the Subcommittee completed its inspection of the Station that unnecessarily aggravated the civilian personnel of A&R. On August 9, 1943, a vacuum cleaner was repaired and the order for the job indicated that it was to be delivered to the A&R Officer. We do not know whether this was the personal vacuum cleaner of the A&R Officer, but we do know that it was so regarded by civilian employees. One can well appreciate the reaction of employees, who believe that the A&R Officer, notwithstanding his order setting forth penalties to which civilians and enlisted personnel may be subjected, has devoted government labor to the repair of a personal use item. If it was not the A&R Officer's personal vacuum cleaner, this fact should have been made clear to the employees repairing it. If it was his personal vacuum cleaner, it is equally important to their understanding of the situation that they be apprised that he has made appropriate reimbursement for its repair.

9. Relation between A&R and Supply Department.

(a) Functions of the Supply Department

The Supply Department orders aircraft parts for the Station and supplies these parts to A&R as the need arises. Delay in making necessary parts available to A&R seriously impairs the efficiency of production, but A&R and Supply have cooperated well in working out supply problems to their mutual advantage. For example, A&R employees are authorized to check directly in Supply to determine whether particular parts are available and to expedite their delivery to A&R.

Supply also receives and stores all material awaiting repair and delivers it to A&R for repair. A&R returns these parts to Supply, when they have been repaired, for issue to the squadrons or to A&R should they later be needed in the repair of aircraft.

(b) Replenishment of Supply Department Stocks

The Planning Division of A&R helps the Supply Department in arriving at the ultimate number of replenishment parts to be ordered from major supply depots. Replenishment lists were formerly based on estimated requirements for six and eighteen-month periods but at the present time they are prepared on a twelve-month basis.

For the purpose of advising Supply with respect to replenishment lists, the Planning Division requires that the shops indicate a recommended stock of parts whenever they order them from Supply. These recommendations are reviewed in the light of the number of airplanes assigned to the Center, the rate of replacement previously experienced for the identical part, the expected overhaul load, and the number of anticipated accidents. When Supply is preparing its final periodic replenishment list, it checks the stock control cards and notes on the lists the quantities on hand and on order, and the quantities used during the last replenishment period. In this form, the list is forwarded to A&R for its recommendations on the basis of the information which the Planning Division has accumulated from the shops and elsewhere. Supply then makes its final determinations and places orders accordingly with the appropriate supply sources.

(c) Issuance of Parts by Supply Department to A&R

(1) Initiation of Parts Procurement. As heretofore stated, aircraft are disassembled and inspected in the Overhaul Control Division of A&R. The Parts Procurement Section of this division immediately requisitions the replacement parts which inspection indicates to be necessary. Thus, a substantial percentage of the necessary replacement parts are ordered even before the parts are sent to the divisions that will perform the actual repair work, and the A&R Officer states that commencing procurement at this stage has materially aided in securing parts from Supply on time.

Certain sub-assemblies (e.g., landing gear, oleo struts, surfaces, engines, engine accessories, and aircraft accessories) are not completely disassembled in Overhaul Control with the result that it is not possible to place orders for replacement parts until the subassemblies have been broken down and inspected in the appropriate division.

(2) Procurement Procedures for Replacement Parts. Replacement parts are ordered from Supply by four divisions of A&R: Overhaul Control (Parts Procurement Section); Accessories; Engine Overhaul; and Planning Division (Material Section). A majority of the replacement parts are procured by the three production divisions.

The Parts Procurement Section of Overhaul Control and the Material Groups assigned to Accessories and Engine Overhaul prepare requisitions in appropriate form and forward them directly to the Supply Department for their respective division. 35/ In any Production

35/ The form of the request differs depending upon whether the material or part is known to be in the Supply Department, must be procured or manufactured, or is standard AN, NAF or AC equipment.

division other than these three, the shop planners submit their requests for parts and materials to the Parts Procurement Section of Overhaul Control, which checks its records to determine whether it has already ordered the requested part for the particular aircraft. If this check is negative, a further check is made by A&R employees assigned to the Supply Department Storehouse to determine whether the requested part is available in Supply, and, in this event, the Procurement Section issues a stub requisition for it to supply, and advises the shop that the part has been ordered.

A somewhat different procedure is followed in the case of standard items, such as bolts, nuts, tube fittings, etc., where the shops send all requests to the Material Section of the Planning Division, which checks the stock in Supply and, if the material is available, prepares a stub requisition and transmits it to the Supply Department. In this fashion, procurement of items which are used commonly by many of the divisions is centralized in one group and control of stocks and preparation of replenishment lists is thereby simplified.

(3) Delivery of Parts from Supply to A&R. The Subcommittee requested A&R to furnish it an analysis of a representative number of requisitions, which would indicate the interval required to secure replacement parts from the Supply Department. The following table shows the time lapse between the initiation of procurement requests and the receipt of parts in the division receiving sections:

Division	1 Day or Less	2 Days	3 Days	4 Days or more	Total
Accessories	27	28	9	80	144
Engine Overhaul*	93	-	-	-	93
Parts Procurement	24	45	45	22	136
Planning	43	19	19	32	113
Total	187	92	73	134	486

*All parts requisitioned by Engine Overhaul Division were received the same day.

It is apparent that the most appreciable time-lag in the delivery of parts occurred in connection with those ordered by the Accessories Division; the shortest lapse was in Engine Overhaul where parts are almost always received the same day they are ordered. Although the proximity of Engine Overhaul to the engine parts storerooms somewhat facilitates delivery to this division, the regularity of these deliveries indicates an efficient procurement system in Engine Overhaul and the cooperation of the Supply Department might well be duplicated in the other procurement divisions.

The Accessories Division seems to raise a rather complicated problem. Of the 144 requisitions selected from this division, 32 were filled after a lapse of 15 or more days. One of the requisitions required 78 days. The delay with respect to most of the requisitions appears to have been occasioned by the necessity for the Supply Department to procure the parts from other sources because they were not available in the Supply Storehouse. If as many as 32 out of 144 requisitions regularly require procurement of parts by Supply from major supply depots instead of a simple delivery from its storerooms,

it may well be concluded that replenishment orders for aircraft accessories have been inadequate or have not been forwarded to the proper authorities in time to receive the replenishments before the existing stock was depleted. 36/ In any event, it seems that the Supply Department should adopt every measure possible to expedite the dispatch of aircraft accessories to A&R.

10. Relation between A&R and Naval Bureaus and Offices.

(a) Blueprints

(1) Delay in Receipt of Blueprints. - The operation of A&R has been seriously handicapped at various times by reason of excessive delays in the receipt of blueprints for aircraft from the Bureau of Aeronautics in Washington. For example, as late as June 15, 1943, it had not received blueprints which it requested on September 2, 1942, although the airplanes to which the blueprints relate were received on the Station on November 18, and December 10, 1942.

The following table shows, among other things, the delay in the receipt of blueprints, the efforts of A&R to expedite their delivery, and the date they were delivered to A&R.

36/ With respect to the procurement of aircraft instruments, see Section 10(e), infra.

U. S. NAVAL AIR STATION, CORPUS CHRISTI, TEXAS
Assembly and Repair Department

Airplane Blueprint Schedule

DATE OF RECEIPT OF AIRPLANE	AIRPLANE MODEL	PROGRESS OF ACTION TAKEN TO OBTAIN BLUEPRINTS					STATUS AS OF JUNE 15, 1943	NUMBER OF REQUESTS		TOTAL NUMBER OF AIRPLANE MODELS
		Date Requested	Date Answered	Date of Follow-Up	Date Answered	Date Received	Number Received	Number Not Received	Known Requests	No Data as to Request (c)
1941										
Jan. 21	JRF-4, -5	(a)				Aug.1, 1942	2			2
				(Nov. 24, 1941						
Mar. 14	GB-1	Nov. 13, 1941		(Dec. 19, 1941	Dec. 21, 1941	Dec. 27, 1941	1		1	
						Mar. 21, 1941				
Mar. 21	N2S-1, -2, -3	(a)				(approx.)	3			3
				(Dec. 27, 1941						
July 14	F3F	Nov. 13, 1941		(Feb. 14, 1942		April 11, 1942	1		1	
Aug. 5	SNV-1	(a)				June 26, 1942	1			1
Aug. 5	SBC-3, -4	Nov. 13, 1941		Dec. 27, 1941		(Dec. 27, 1941(b)				
				(Feb. 14, 1942		(Apr. 20, 1942(c)	2		2	
Aug. 30	JRB-2	Nov. 13, 1941		(Dec. 27, 1941		(Jan. -, 1942(d)				
				(Jan. 29, 1942		(No data	1		1	
Sept. 2	PBY-1, -2, -3	Aug. 14, 1941	Oct. 9, 1941			Sept. 9, 1941	3		3	
1942										
Feb. 18	J2F	Jan. 30, 1942				Apr. 27, 1942	1		1	
June 25	PBY-5B	(a)				June 7, 1943	1			1
July 2	SNJ-4	(a)				May 1, 1943 (e)	1			1
July 13	TBD-1	Sept. 2, 1942				Oct. 4, 1942	1		1	1
July 18	GH-1	Sept. 2, 1942		Mar. 5, 1943	Mar. 17, 1943	Mar. 30, 1943	1		1	
Aug. 17(f)	NF-1	Nov. 5, 1942				Feb. 23, 1943	1		1	
Sept. 16	PBY-5A	Sept. 2, 1942	Mar. 17, 1943			Sept. 19, 1942	1		1	
				(Feb. 14, 1942						
Oct. 24	OSU-2, -3	Aug. 14, 1941	Oct. 9, 1941	(July 30, 1942	Aug. 17, 1942	Aug. 11, 1942	2		2	
Nov. 18	SNB-2	Sept. 2, 1942		Mar. 5, 1943	(g)			1	1	
Dec. 10	NE-1	Sept. 2, 1942		Mar. 5, 1943	(h)			1	1	
1943										
Jan. 7	SNB-1	Mar. 5, 1943			(g)			1	1	
Jan. 30	PBY-5	(a)				Apr. 13, 1942	1			1
						SUB-TOTAL	24	3	18	9	27
(i)	R5O-5, R4D-4 (TBF-1, F2A-2,							2		2	2
(j)	(SBD-1, SO3C-1					No data	4			4	4
						TOTAL	28	5	18	13	33

LEGEND:

(a) - Record incomplete prior to Sept. 1, 1942
(b) - SBC-4 prints received
(c) - SBC-3 prints received
(d) - Partial
(e) - First shipment
(f) - Designated manufacturing agency
(g) - Notified shipment due May 15, 1943; May 17, 1943
(h) - Notified shipment due Jan., 1943; Mar. 17, 1943
(i) - One (1) each assigned to Station. Prints not requested; not received
(j) - Airplanes not assigned to Station. Prints received

Delays in the receipt of blueprints have necessitated the overhaul of aircraft without blueprints with the result that disassembly of the airplanes was retarded and employees had to follow parts around to the various divisions so they would not become lost. It was stated that it would have been almost impossible for the relatively inexperienced personnel to identify these parts if they were lost. Moreover, where it was necessary to manufacture replacement parts for these aircraft without blueprints, samples had to be used for the purpose, and the Department frankly admits that, under such circumstances, it could not be sure of the tolerances of these parts.

The delay of the Bureau of Aeronautics in sending blueprints to A&R has obviously hampered the operation of A&R and been the cause for considerable waste and inefficiency in the overhaul and repair of aircraft. Representatives of the Bureau advised us that it plans to microfilm blue prints and that it is expected that this will materially expedite their dispatch to air stations. If the Corpus Christi A&R Department is a criterion, there is an imperative need for expediting the delivery of blueprints, and the plan of the Bureau of Aeronautics for this purpose should be put into complete operation at the earliest possible moment.

(2) Incorrect Blueprints - We were advised by A&R that the number of incorrect blueprints received at the Station is relatively negligible, but, they did not reflect manufacturers' local changes which had been incorporated in the aircraft after the issue of the prints to the A&R Department. Frequently, production line changes have been made by the contractor, with engineering approval, and, consequently, are not evidenced on the prints issued by the Bureau.

A&R takes the position that the deviations between the planes and the blueprints which it receives are primarily attributable to the policy of the Bureau of Aeronautics which precludes the issue of contractor information directly to the various service activities and requires that all such information be disseminated by the Bureau of Aeronautics. If the Bureau deems it advisable to continue to disseminate change information, it should be transmitted promptly and accurately to the stations.

(b) Part Numbers

Aircraft parts are carried in stock in Supply under various numbers. Most aircraft parts have been given A&R stock numbers which are identical with manufacturers' part numbers. Such is not the case, however, with respect to parts procured under Army-Navy (AN), Naval Aircraft Factory, and Air Corps standard specifications, which, although they originally carry specific part numbers, have been assigned new arbitrary stock numbers by the Aviation Supply Officer. 87/ The assignment of these arbitrary numbers makes it necessary for industrial personnel to decode part numbers into the stock numbers. Naturally, this operation consumes a great deal of time and increases the chance of error.

The A&R Department has taken measures to eliminate the difficulties in the shops caused by the arbitrary assignment of stock numbers to AN, Naval Aircraft Factory, and Air Corps parts by setting up a special stock room where these parts are carried by their part numbers. According to the A&R Officer, this has materially expedited the procurement of parts from the shop stores by industrial personnel.

87/ Other classes of material, such as webbing, fabric, tapes, paints, cleaning compounds, etc., are necessarily carried under an arbitrary (cont'd)

However, this special storeroom still must order the parts from the Supply Department by the arbitrary numbers.

It should be pointed out also that the assignment of arbitrary stock numbers to standard AN parts is apparently hindering the operation of other naval activities. On May 19, 1943, the Commanding Officer of the Naval Air Station at San Diego, California, wrote the Aviation Supply Officer in Philadelphia recommending that the AN part numbers be used as stock numbers. He also sent copies of this letter to all Class A overhaul bases for their comments on the proposal. The Naval Air Station at Corpus Christi, in a letter, dated June 4, 1943, informed the Aviation Supply Officer that it heartily endorsed the suggestion of the San Diego Station and took the position that the assignment of AN part numbers as stock numbers would naturally expedite the procurement of material.

The Commanding Officer of the San Diego Station pointed out that the use of arbitrary stock numbers for parts known to industrial personnel by their AN numbers has the following harmful effects:

(a) Increases the chances of delaying information or obtaining incorrect information as to availability of stock;

(b) Increases the number of persons engaged in handling stock records;

37/ (cont'd.) stock number because it is not desirable to use the specification number as a stock number for this type of material.

(c) Wastes the time of industrial personnel, the saving of which is particularly important at this time when every effort is being made to reduce the elapsed days during which airplanes remain under overhaul.

The stocking of aircraft manufacturers' parts under their part numbers has been of material help to shop personnel and has not presented any difficulty in withdrawing stores. Similarly, it seems that utilization of AN part numbers as stock numbers would be a valuable aid to them. The Supply Officer of the Naval Air Station at Corpus Christi apparently agrees with us because he advised us, in reply to our inquiry, that:

> "In the opinion of the Supply Department, the use of the AN number is preferred for all types of parts not peculiar to a particular airplane, engine or accessory, in which case the use of the manufacturer's part number is desirable."

The recommendations of these activities that AN part numbers be utilized as stock numbers appear to be adequately supported by the facts. The Aviation Supply Officer should take immediate steps to put this system in operation because the present practice is causing inconvenience and, as more parts are standardized, the magnitude of the problem will increase correspondingly.

(e) Equipment Problems.

(1) Needed Equipment. The AAR Department has forwarded a project order to the Bureau of Aeronautics for approximately $95,000 worth of additional equipment which is itemized in Exhibit F, attached. The funds for this purchase have not been allocated nor has AAR received

the contracts. If A&R is to meet its expected schedule of high time overhauls, it will need this equipment. Accordingly, the Bureau of Aeronautics should take appropriate measures to approve the order and provide for its purchase.

(2) Non-Use of Equipment. A&R has acquired some equipment that has never been used and some that it is not using at the present time.

As of July 22, 1943, A&R had two grooving machines (a hand-operated machine costing $48.00 and a motor drive one costing $422.75) which have never been used because they are Tinners' Type units for forming parallel grooves in sheet iron, an operation that is not performed in A&R. The availability of these machines should be called to the attention of the appropriate officials for transfer to any activity that may need them.

A&R also has a flat-belt brake shoe lining grinder which cost $485.00 and has never been used because the Department feels that the work is performed more efficiently by a disc-type grinder. However, the Department does plan to utilize this machine by adapting it to other purposes.

A&R has initiated measures to provide for transfer of certain equipment which it no longer uses to other activities. Thus, on June 5, 1943, the A&R Officer requested that the Supply Officer arrange for the transfer of two stands and manifolds for carbon dioxide cylinders because the Station had installed converter equipment for carbon dioxide which is used in aircraft fire extinguishers. On

June 12, 1943, the Commanding Officer recommended to the Bureau of Aeronautics that seven hydraulic platforms and two aircraft brake-testing machines, which had not been used since they were installed, be transferred to other activities because the overhaul production-line system consumed all available floor space. The brake-testing machines had a rather interesting history. We understand that the former Division Superintendent of Assembly and Test objected vigorously to their purchase on the basis that they would not be used, and that they were installed against the wishes of the present superintendent of that division. Moreover, they had only been used three times and then for demonstrational purposes. It was stated that the machines would have been wasteful because they tore a substantial amount of rubber from the aircraft tires and, furthermore, they were not needed because the brake shoes and drums are precision-ground and set at .010 clearance with feeler gauges and new brake bands are installed on each overhaul. One man estimated that utilization of these machines would have added 20 additional man-hours to the time required to overhaul an airplane.

On June 30, 1943, it was requested that the Supply Officer arrange for the transfer of two sewing machines for which there is no need in A&R. In addition, there is other equipment held in A&R awaiting survey pending the necessary action.

A&R also has nine machines that once were used but are no longer utilized. Some of these machines will be used again as replacements

for machines now in use, one is awaiting survey, and the remainder will shortly be placed in operation because of the expected increase in the work load of the Department.

It is normal, of course, that a repair base of this size will have an unbalanced work load on its machine tools because of the constant variations in the classes of work performed on different types of aircraft and that machines will be idle at times and then be operated at maximum capacity during other periods. Nevertheless, it is important that no unnecessary equipment be tied up if it can be used elsewhere, and every care should be exercised to utilize it efficiently.

(d) Material Shortages

Overhaul and repair of aircraft parts and engines have been and are still being delayed by material shortages. In an effort to minimize the effect of shortages of replacement parts, A&R has borrowed a part or parts from one airplane to use on another of the same type so that aircraft would not be held up on the assembly line. In this way, A&R has been able to keep airplanes moving back to the squadrons despite the fact that necessary replacements were not available as needed. It is clear that the practice has aided A&R and is far better than letting aircraft accumulate in A&R until the replacement parts are secured or manufactured.

Since the Machine and Metals Division is equipped to manufacture the greater portion of the parts needed in the overhaul and repair of aircraft, the most critical shortage is that of raw materials. Some

of these raw materials, which have been difficult to obtain, are: stainless steel sheet stock, chrome molybdenum steel bar stock, aluminum alloy tubing, zinc chromate, aluminum alloy bars, etc. However, the Department has also had great difficulty in obtaining small hand tools of all types and precision tools, such as micrometers and gauges.

(e) Changing Army and Navy Instruments

(1) Nature of the Problem The Navy utilizes a number of aircraft procured by the Army and the Army uses aircraft procured by the Navy. The Bureau of Supplies and Accounts issued a circular letter regarding the overhaul of the instruments of Army airplanes, which was also made the subject of Bureau of Aeronautics Circular Letter No. 42-41, attached as Exhibit G. This letter provided, in effect, that the Navy would not overhaul Army instruments and vice versa; that defective Army instruments would be returned to the Army by the Navy and vice versa; and that each service would use its own instruments as replacements if there were acceptable substitutes. Acceptable substitutes were defined as those which required only modifications to the cut-outs on the instrument panels and replacement of fittings, if they were not of the AN type.

Compliance with the terms of this circular letter has raised a number of serious problems in the A&R Department. 28/ The Station has a large number of Army-procured aircraft and, under existing orders,

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28/ The Subcommittee requested that the A&R Department furnish it with a statement as to the scope of this problem and its effect on the operation of A&R. It also requested that the Instruments Branch of the Bureau of Aeronautics explain its position on this problem. These statements are attached as Exhibits H and I, respectively.

all Army instruments, except fuel quantity float gauges for which there is no Navy replacement, are to be replaced with Navy instruments. Accomplishment of these orders require modification of both the front and rear instrument panels. The cut-outs for the Army instruments have to be changed to fit Navy instruments. Aside from the time it takes to make the necessary modifications to the panels, 39/ AAR points out that in at least one instance the changes raise a safety problem. The bracket for the Navy type compass protrudes from the rear panel and forms two sharp edges which might cause a serious injury to the pilot if the aircraft should come to a sudden stop. Moreover, these edges might well interfere with the pilot's parachute in the event he was forced to bail out.

Some of the changes required under existing orders can be accomplished within a short period of time and with a minimum degree of effort. Others take a great deal of time and have presented a real problem to the Department. There follows, in the succeeding paragraphs, a discussion of some of these changes.

39/ With respect to the time consumed in making the necessary modifications to instrument panels, AAR furnished the Subcommittee with the following estimates:

"(a) In changing the Army Compass to Navy in the front cockpit, including insertion of metal plate for security - . . . . . 3 hours.

"(b) In changing the Army Compass to Navy in the rear cockpit, including manufacturing time of the bracket . . . . . 4 hours.

"(c) In changing Army Clock to Navy by filing new cut-outs in panel (both cockpits). . . . . 45 minutes.

"(d) In changing Army Manifold Pressure Gauge to Navy (front cockpit) . . . . . 30 minutes.

"(e) In changing Army Rate of Climb to Navy (both cockpits) . . . . . 45 minutes.

"(f) In changing Army Altimeters with Navy (both cockpits) . . . . . 45 minutes.

"(g) In changing Army Tachometer Generator with Navy (Installation of bracket) . . . . . 30 minutes."

(2) Changing Airspeed Indicators. The Army airspeed indicators, which are initially installed in Army-procured aircraft, are calibrated in miles per hour. As these airplanes were delivered to A&R for overhaul, the Army airspeed indicators were replaced with Navy indicators, which were calibrated in knots. Consequently, airplanes in the same squadron were flying with instruments of different measurements, and the pilots were unable to tell whether their airspeed indicators were calibrated in knots or miles per hour. One can well imagine the hazards of formation flying under such circumstances. However, the confusion which necessarily resulted from this situation was eliminated by painting "M.P.H." or "KNOTS" on the instrument glass. But, even this was ineffective to remove completely the hazards involved in the formation flying of planes with instruments which were calibrated differently. For this reason, on January 16, 1943, Local Technical Order No. 3-43 was issued to provide that all airspeed indicators should be calibrated in knots and that arrangements for this should be made by the Planning Superintendent with such squadrons as desired the change made before the regular overhauls.

Alterations required by this order soon depleted the stock of Navy airspeed indicators in Supply. Because of this shortage, the Department issued Local Technical Order No. 25-43, on March 29, 1943, providing that the airspeed indicators on Army-procured aircraft should be calibrated in miles per hour and that those on

Navy-procured aircraft should be calibrated in knots. This order placed ASR in the rather anomalous position of recalibrating to miles per hour the Army airspeed indicators which it had previously changed to knots. Moreover, calibration of Navy instruments which had been installed in Army airplanes from knots to miles per hour was also undertaken, although it is said that only one type of Navy airspeed indicator (U.S.Gauge, FSSC #88-I-325) could be calibrated in miles per hour and that only two out of five of these instruments could be so calibrated accurately. It was stated that changing the calibration to miles per hour consumes from 5 to 8 man-hours. Also, morale in the Instrument Shop of ASR was seriously affected when the men were required to recalibrate to miles per hours the airspeed indicators it had previously changed from miles to knots. If the waste and collateral difficulties caused by these changes were necessary incidents to the repair and overhaul of the airplanes, we would have no quarrel with them, but they appear to have been occasioned by bad planning and lack of foresight.

In this connection, the Officer-in-Charge of the Instruments Branch of the Bureau of Aeronautics stated:

> "It is very difficult to modify the mechanism of an airspeed indicator calibrated in knots so as to calibrate it in miles-per-hour or vice versa. I am amazed that any major overhaul station should attempt this; however, with such lack of knowledge it is to be expected during wartime. We did procure replacement Navy knot dials for Army airspeed indicators and instructed all Naval Reserve Aviation Bases to obtain them from the Naval Aircraft Factory, Philadelphia. Apparently this letter was not available at the overhaul office at Corpus Christi."

According to A&R the inadequate stock of airspeed indicators in the Supply Department was the reason why these instruments were recalibrated to miles per hour. However, the Officer-in-Charge of the Instruments Branch of the Bureau of Aeronautics states that there was a huge stock of Navy airspeed indicators available at designated stocking points, when the order for recalibration was issued, 40/ and that it has actually been necessary to hold down production of airspeed indicators and practically all other airplane instruments. Thus, it appears that the issuance of this order, which has caused so much confusion in the operation of A&R, might well have been obviated if the Supply Department of the Station had been reasonably vigilant in procurement of airspeed indicators.

(3) Installation of Navy-type Tachometer and Manifold Pressure Gauge on Aircraft Used for Instrument Flying.

The Station requires that Navy tachometers and manifold pressure gauges be installed on SNV-1 airplanes. The change is relatively

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40/ The Officer-in-Charge of the Instruments Branch of the Bureau of Aeronautics also supplied the following information:

> "The low-speed Army airplanes use the 0 to 160 knot Navy type Federal Standard Stock Catalog No. 88-I-340. The high-speed Army airplanes use the 0 to 430 knot type FSSC No. 88-I-350. Stocks of each in good condition ready for issue at Corpus Christi and the total available at the major stocking points are shown in the following table as of the dates indicated:

Airspeed Indicator Stocks

	88-I-350		88-I-340	
	Total	Corpus Christi	Total	Corpus Christi
31 January 1943	7301	125	8606	244
28 February 1943	8397	61	7703	565
31 March 1943	6503	32	7518	570 "

easy to accomplish and takes very little time, but it has caused a serious loss of man-hours in A&R because the squadrons sometimes undertake the job by themselves and do not complete the full change. Thus, the squadrons have frequently sent aircraft to A&R for overhaul with the manifold pressure gauge changed but with the Army-type tachometer still in use. Unless A&R notices this condition on disassembly and inspection, production time is lost when it becomes necessary to complete the change after the aircraft reaches final assembly. Since A&R can ill afford unnecessary delays, arrangements should be made to have the squadrons advise A&R whether they have completed the change before delivering the plane for overhaul, in order that this information may be brought to the attention of the worker on the bench.

(4) Installation of Navy-Type Carburetor Air Temperature Gauges. A local technical order requires that Army carburetor air temperature gauges be replaced with the Navy type. This order necessitates the manufacture of distinguishing name plates because the Navy replacement for the Army free air temperature gauges and carburetor air temperature gauges is one and the same instrument. Therefore, a name plate is manufactured designating one Navy replacement as a free air temperature gauge and the other as a carburetor air temperature gauge in order to prevent confusion. 41/

41/ Installation of Navy replacements requires wiring changes. In making the wiring changes for various Army instruments, A&R estimates that the following man-hours are required:

"(a) Changing wiring to replace Army Tachometers with Navy . . . . . 2 hrs.
(b) Changing wiring to replace Army Engine Gauge Units . . . . . 6 hrs.
(c) Changing wiring to replace Army Carburetor Temperature Gauge . . . . .2 hrs. (cont'd)

It does not appear to us that the manufacture of these name plates presents any real problem. In any event, it is now becoming academic because the Navy instrument has been standardized by the Army and Navy. Had the Army's system of placing the name plate on the instrument been agreed upon as the standard, supply points would have to stock fourteen different models of thermometers, the only differences being in the functions performed. Under the Navy's policy of using a single thermometer and designating it by a name plate on the instrument board, a tremendous stocking problem has been avoided.

(5) Changes Peculiar to SNB-1 Aircraft. The Department has not installed Navy-type pitot static tubes on SNB-1 aircraft. The Department states that its reasons for not doing so are that no Navy-type static tube will function in the same position as the Army-type and that installation of the Navy type would require that tubing be installed to the wing tips. The Station has received eight Army-type pitot static tubes and indicated that, when these are exhausted, it will have a very hard time making the necessary changes.

The Officer-in-Charge of the Instruments Branch of the Bureau of Aeronautics advises us that the Navy does have a replacement

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41/ (cont'd.)
"(d) Changing wiring to replace Army Free Air Temperature Gauge . . . . . 2 hrs.
(e) Changing leads to replace Army Cylinder Temperature Gauges . . . . . 1/2 hr."

for the pitot static tube of the SNB-1 airplane which is identical with the Army-type and has been stocked at supply points. It is in the process of being standardized as an AN instrument.

AAR also replaces the dual Army cylinder temperature gauge in SNB-1 aircraft with two Navy indicators. One replaces the defective Army instrument in the same cutout, and the other is installed in the cutout for the Army fuel-air ratio indicator, which has no Navy counterpart because the Bureau of Aeronautics does not approve its use. The installation of two separate indicators by AAR was actually unnecessary because there is a dual Navy-type in existence and available. None of these were stocked at Corpus Christi, but we are advised that, throughout the nation, the following quantities were available on the dates indicated: January 31 - 1065; February 28 - 934; and March 31 - 482.

In view of the circumstances set out above, it appears that much of the difficulty experienced by AAR with respect to SNB-1 aircraft either results from ignorance of the suitable Navy replacements or from the failure of appropriate officials to initiate procurement requests.

(6) Lack of Army Replacement Parts. The inability to obtain spares and replacement parts for Army instruments for which there are no suitable substitutes has also handicapped AAR. As previously indicated, there is no Navy replacement for the fuel quantity gauge fleets on SNV-1, SNJ-3, and SNJ-4 aircraft, but AAR

has received no spares or replacement parts and has had to rely on salvaged aircraft as the sole source of supply. Similarly, the Department has been unable to obtain any replacement parts for the Army drift sight. Although the Navy drift sight can be installed in place of the Army sight, the Department indicates that it would be very impractical to do so because it would take at least 100 man-hours. 42/ Measures should be taken in order that spares and replacement parts for such instruments will be made available to A&R at the earliest possible moment.

(7) Supply of Navy Instruments. The preceding subdivisions of this section indicate to us that much of the difficulty encountered by A&R in changing Army to Navy instruments has been caused by its inability to obtain sufficient Navy instruments from the Supply Department and outside sources of supply. Although the Officer-in-Charge of the Instruments Branch of the Bureau of Aeronautics states that the production of aircraft instruments has been excellent and that it has actually been necessary to curtail production for the past seventeen months, it is conceded that distribution of replacement instruments has been very poor. This is substantiated by the fact that, as of July 14, 1943, the Supply Department of the Station had forty-three unfilled shipping requests for aircraft instruments, which had been outstanding from 30 to 75 days.

(8) Remedial Action. The Instruments Branch of the Bureau of Aeronautics is thoroughly cognizant of the difficulties encountered

42/ See also the remarks of the Officer-in-Charge of the Instrument Branch in Exhibit I, attached, with regard to changing drift sights.

by overhaul bases in changing Army instruments to Navy types. It has initiated constructive measures designed to eliminate many of these. Such measures and the reasons for them are as follows:

(a) Cancellation of Bureau of Aeronautics Circular Letter No. 43-41 and the Bureau of Supplies and Accounts letter on which it was based. These directives, pursuant to which overhaul bases replace Army instruments with those of the Navy, are no longer deemed expedient because the Navy operates a large number of Army-procured aircraft and vice versa. The Instruments Branch initiated action for the cancellation of these directives on July 23, 1943, and has obtained the oral approval of the Army Air Forces to their cancellation.

(b) Initiation of the procurement of a large number of Army instruments and replacement parts. The Branch plans to procure Army instruments for which there are acceptable Navy substitutes, as well as Army instruments for which there are no acceptable Navy substitutes.

(c) Distribution of aircraft instruments on an allocation basis. Because Supply Officers have generally requisitioned inadequate stocks, the Instruments Branch considers it advisable to dispatch aircraft instruments from major stocking points without waiting for requisitions. It is thought that this practice will aid distribution, shorten transportation time and eliminate a considerable volume of paper work.

(d) Inspection trips to overhaul bases by personnel of the Instruments Branch. The Officer-in-Charge states that a recent inspection of East Coast overhaul bases cleared up a number of misunderstandings and estimates that 90% of the difficulties experienced by A&R could have been eliminated by similar inspections.

We believe that these measures should be very beneficial to overhaul bases and recommend that they be placed in complete operation at the earliest possible date. Although it is to be expected that a certain amount of substitution of instruments will continue to be necessary because of improvements in them and standardization, these measures should go far toward reducing the occasions for such changes to a minimum.

11. Production Record

(a) Analysis of Production

The efficiency of A&R in overhauling and repairing aircraft has a direct relation to the pilot training program in that maximum utilization of airplanes is obviously impossible if a backlog of airplanes is allowed to accumulate in A&R or the overhaul operation is unduly protracted. For this reason, among others, the production record of A&R is of substantial significance. The following schedules reflect this production record for the period from June, 1942 to May, 1943, inclusive.

U. S. NAVAL AIR STATION, CORPUS CHRISTI, TEXAS
Assembly and Repair Department

Aircraft Overhaul and Repair Schedule

MODEL	1942 JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			1943 JANUARY			FEBRUARY			MARCH			APRIL			MAY			TOTAL		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)*
PBY	2	4		1	4	1	1	3		2	4		1	4		1	4		1	1		2	2		2	3		4	4		4	7		4	9		25	49	
F3F		2		1	2	1		1	7	1	3	15	1	4			2		3	1		5													11	15	
SBC		2	1	1	3	4		4	4		1	7	2	1	7	1	4		3	2		5			2			4								18	17	
N3N		4	1			21		7	32		6	36	4	3	10	6	2	4	4			19			12			4	5		16	7		14	3		79	37	
N2S	3	7	1	1	8	1	4	17	6	3	2	9	2	3	18			1			1	11		1	11		1	22	1		32			27			116	38	
SNC		5	21	2	6	31	1	3	30	2	3	45	1	4	57			3	59					4			4									6	25	
SNV		3			1	2		6	8		3	3		4	3					1		1			28			36	8		19	25		1	8		86	58	
GB-1	1				1									1																						1	2	
OS2U	1	7		1	5	2			2		2	5		2	5	3		3		1		2		1	8		1	8			24	1		7			54	18	
SNJ		1			1	6			6		3	10		5	13			12		1	6	2		5	6		5	[illegible]	25		1	18		13	56		22	110	
JRF											1						1																				-	2	
PBM																													1								-	1	
SNB																													1								-	1	
N2T																														2		3	2		1	2	-	4	
JRB																																1					-	1	
TBF																																	2			2	-	-	
R5O																																			1		-	1	
Total	7	35	24	7	31	69	6	41	95	8	28	130	11	31	113	11	16	79	12	7	9	47	2	11	69	3	11	78	45	2	96	62	4	66	78	2	418	379	*

LEGEND:
(1) - Major Overhaul
(2) - Minor Repair
(3) - Awaiting Repair
(3)* - Same as at May, 1943

RESUME OF AIRPLANES AWAITING REPAIR

1942	Number	Decrease or Increase Over Previous Month
June	24	Not Known
July	69	45
August	95	26
September	130	35
October	113	17
November	79	34
December	9	70
1943		
January	11	2
February	11	0
March	2	9
April	4	2
May	2	2

U. S. NAVAL AIR STATION, CORPUS CHRISTI, TEXAS
Assembly and Repair Department

Engine Overhaul and Repair Schedule

MODEL	1942 JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			1943 JANUARY			FEBRUARY			MARCH			APRIL			MAY			TOTAL		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)*
R670	15	1	45	19		40	36		19	52		22	35		7	35			5			6			19			23			12	4		5	11		262	16	
R680	14		31	24		31	42	1	9	19		12	9		19	24	1	6	10		4	2		5	22		1	5		1	3	8	7	39		4	213	10	
R760	21	2	60	17		52	10	1	49	5	3	56	31	5	71	12	3	84	23	1	94	35	1	34	9		10	32		14	6	18	25	20		31	221	34	
R975	9	9	57	10	6	57	1	3	59	3	4	59	35	1	54	7	1	57	16		63	23	2	54	118	2	45	10	1	34	18		34	5		31	255	29	
R985	28	3	74	53	3	33	29	2	37	21	2	60	26	4	75	1	1	120	8	4	185	32	2	126			44	66	2	35	82	21	0	154	5	48	500	49	
R1820	8	9	14	3	4	20	1	4	47	1	5	46	3	7	15	5	2	15	2	1	10	12		11											1		35	33	
R1830	8		19	4	7	11	1		44	3	4	46	6	3	59	7	1	57	11	2	62	19	1	58	20		51	4	4	47	9	1	49	27	6	51	119	29	
R1340							2	4		2		2	5		11	8		2	10	2	8	3		10	22	3		31	3	24	49	9	2	83	3	31	215	24	
R1535			8																																			
Total	103	24	308	130	20	244	122	15	264	106	18	303	150	20	311	99	9	341	85	10	426	132	6	298	210	5	151	171	10	155	179	61	117	333	26	196	1820	224	*

LEGEND:
(1) - Major Overhaul
(2) - Minor Repair
(3) - Awaiting Repair
(3)* - Same as at May, 1943

RESUME OF ENGINES AWAITING REPAIR

1942	Number	Decrease or Increase Over Previous Month
June	308	Not Known
July	244	64
August	264	20
September	303	39
October	311	8
November	341	30
December	426	85
1943		
January	298	128
February	151	147
March	155	4
April	117	38
May	196	79

Thus, it appears that the overhaul and repair of aircraft and aircraft engines has increased since the reorganization of AAR. Since January, 1943, it has performed major overhauls on a substantial number of airplanes. 43/ However, several factors other than the mere number of airplanes overhauled and repaired and the corresponding reductions in the backlog are equally important in evaluating the work and efficiency of the Department. The most significant of these are: (1) the floor space and equipment used, (2) the type of aircraft, (3) the reason for the overhaul, i.e., high time or crash, (4) whether the airplane has previously been overhauled, and (5) the personnel complement of the shops.

The floor space devoted to assembly and repair work has been enlarged during the year covered by the schedules until, at the present time, 690,071 square feet are utilized for this purpose. Additional equipment has been installed from time to time. Moreover, during this period, the personnel complement was increased by approximately 2400 employees. Some of these employees have now been in the Department for some time and have naturally become more conversant with their work. All of these factors have contributed to the increase in the number of overhauls and repairs accomplished per month. We also understand that a greater portion of the overhauls performed during the early part of this period

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43/ A major overhaul involves disassembly of an aircraft to an extent that permits inspection of all parts and the accomplishment of all repairs, together with the incorporation of all outstanding changes and the replacement of engines, accessories, instruments, etc. with similar new or overhauled equipment. The general purpose of this operation is to restore aircraft to a new condition so far as this is possible. The repairs referred to in the foregoing schedules require extensive equipment and personnel.

was occasioned by crashes. A major overhaul necessitated by a severe crash usually requires more time than a high time overhaul. Similarly, the type of aircraft overhauled also has an effect on production, e. g., approximately 1300 hours, in addition to the normal time required for overhaul, had to be devoted to one type of aircraft on the Station because of the changes in this particular type of aircraft.

After making an allowance for each of the foregoing factors, it appears that A&R has made progress toward increasing its productivity. 44/ But this does not mean that it can overhaul the increased load scheduled for this autumn without rectifying a number of its procedures. It is the firm conviction of this Subcommittee that these procedures and practices must be corrected if A&R is to function efficiently and make its maximum contribution to the operation of the Station.

44/ The Bureau of Aeronautics has set up descriptive definitions for the different types of work of the overhaul bases for the purpose of monthly progress reports. The Subcommittee obtained a number of these reports in order to compare the Corpus Christi A&R Department with other departments. Each station, however, has interpreted the definitions of the Bureau of Aeronautics in a different manner and no accurate comparison can be drawn. The Bureau of Aeronautics should insist that overhaul bases uniformly interpret its definitions or dispense with the type of voluminous progress report that is filed at the present time.

PART FIVE

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

1. Findings and Conclusions

Based upon our inspection of the Naval Air Training Center, interviews with its personnel, and collateral inquiries, we find and conclude that:

(a) General - The Center is well located for training pilots, its facilities for this purpose are adequate, and the pilot training program is progressing satisfactorily.

(b) Personnel - Administration of personnel appeared to be rather poor for the entire station and, particularly, for the Assembly and Repair Department. There seems to be no well planned civilian personnel policy and no adequate machinery for establishing one.

Enlisted personnel serve in aircraft ground crews, assembly and repair shops, clerical, and every other type of position, and they constitute approximately 50 percent of all personnel.

Both officer and enlisted WAVES are utilized in the station, but they have been used principally to augment the staff rather than to relieve male personnel.

The recruitment of civilian personnel has presented no real problem in the unclassified labor groups and in the non-aircraft skilled trades. However, aircraft workers are difficult or impossible to procure.

(c) Transportation and Housing - Transportation difficulties have been somewhat alleviated by adding busses to the commercial transportation system.

However, housing facilities are inadequate both for naval and civilian personnel. Two hundred family units are needed for officer personnel and about 80 units for white civilian personnel. At least 60 percent of the negro naval and civilian personnel and 45 percent of the Latin-American workers are housed under substandard conditions. Improvement of the housing situation is not in sight because newwar industries in Corpus Christi will draw additional workers to the area.

(d) Supply Department - The organization and facilities of the Supply Department appear to be adequate.

Use of negotiated contracts, in lieu of the traditional competitive contract, has materially reduced the amount of time involved in the procurement of many materials and supplies.

The procedures for handling scrap were generally satisfactory.

Accumulations in storage of materials and parts awaiting repair were excessive and overburdened storage facilities.

(e) Assembly and Repair Department - With respect to the Assembly and Repair Department of the Center:

(1) Personnel - The work of the Department is performed by officer and enlisted naval personnel and by civilian employees, as follows:

(i) All key administrative positions are held by naval officers, many of whom had no previous aircraft or industrial supervisory experience. Civilian employees feel that too many of these officers are dictatorial in manner and are entirely unsympathetic with their problems. There appears to be a total absence of mutual

respect between officers and civilian workers. This has resulted in a very low state of morale which adversely affects production. The condition seems to be attributable in no small measure to inadequacies in management;

(ii) Civilian supervisors and chief petty officers hold comparable production supervisory positions under the direction of naval officers. A number of the civilian supervisors have had a substantial amount of experience in aircraft industries and are very able; a few of them seem to be incapable of getting along with the men they supervise;

(iii) There appears to be no discrimination at the present time in favor of utilization of enlisted personnel instead of qualified civil employees as production supervisors. However, a number of civilians feel that there is an increasing tendency to fill supervisory positions with chief petty officers; and

(iv) Enlisted men and civilians work side by side in the shops at the varying craft levels with little or no friction.

(2) Vocational Training - A&R has tried to mitigate the effect of the inexperience of employees in aircraft work by vocational training:

(i) Courses are conducted for shop supervisors and instructors, and a substantial number of employees receive on-the-job instruction;

(ii) Vocational training facilities of outside agencies have also been utilized; and

(iii) Training courses in aircraft overhaul for enlisted personnel and classes for their advancement in rating are also held. Enlisted men are trained generally as competent aircraft mechanics, but few of them have been transferred to the fleet or other activities.

(3) Personnel Policies - A&R has failed to formulate an adequate personnel program and its administration of personnel matters has contributed to poor morale, dissatisfaction, and unrest among civilian employees. This condition is attributable, in part, to these circumstances:

(i) The time of the A&R Personnel Officer is consumed by paper work with the result that insufficient attention is devoted to consideration of major personnel problems;

(ii) No measures are taken to counteract the many inaccurate rumors which circulate through the shops and create trouble, such as the report that naval personnel alone will be utilized in supervisory positions;

(iii) The A&R Officer has failed, in some instances, to apprise employees fully of their rights and of the policies of the Department with the result that employees regard the administration as vacillating and arbitrary;

(iv) The Department continues to work men in positions other than those for which they are classified for pay roll purposes despite a directive of the Assistant Secretary of the Navy to the contrary;

(v) The administration of the efficiency rating system has been a constant source of dissatisfaction; employees believe that it is used arbitrarily and improperly to force resignations and transfers;

(vi) Many valuable men left A&R for other employments because there was no known policy with respect to promotions. An order of June 15, 1943, which was intended to remedy this situation, is defective in that it conveys the impression that 50 percent of the employees may receive promotions every three months, although it is a certainty that they will not. This order is being revised;

(vii) The check on the authenticity of sick leave by a medical officer after the employee has recovered and returned to work has proved to be unsatisfactory and irritating to personnel; and

(viii) Despite conventional morale building programs, the management of A&R has so undermined morale of civilian employees with unrest, dissatisfaction, and disrespect that it cannot reasonably be expected that there will be any substantial improvement in the condition until there is a complete change in its management and in its fundamental personnel policies.

(4) Absenteeism - Absenteeism resulted in the loss of 334,504 manhours in the first five months of 1943. Inadequate housing facilities, the distance of the station from Corpus Christi, overtaxed transportation facilities, shopping, banking and other personal affairs, domestic help shortages, and the fact that many employees never before received such high wages seem to be the chief causes of unauthorized absences.

An order was recently issued establishing a graduated scale of suspensions without pay for unauthorized absence. The A&R Officer recommended four additional measures to curb absenteeism but none of these has been put into effect.

(5) Labor Turnover - From June 1942 to May 1943, two out of every three civilians hired by A&R were necessarily utilized as replacements of employees who had quit. This rate of turnover is excessive and, if it continues, will seriously affect the operation of the Department.

The principal causes for this turnover seem to lie in more lucrative employment elsewhere, climate and health, family situations, the armed service, housing conditions, transportation facilities, and dissatisfaction with the administration of personnel policies.

To reduce turnover, A&R assigns employees to different types of work and occasionally interviews resigning employees. Although these measures are helpful, it appears that more fundamental changes in personnel relations are necessary if it is to be expected that employees will stay on the job.

(6) Production Policies and Practices - A&R has increased production in its shops during the past year, has developed a suitable system for scheduling aircraft work, and is presently planning an improved method of distribution of scheduling information to the shops. While A&R has established mechanical controls necessary for synchronization of the work of the various shops, it does not fully utilize these controls to insure that production is carefully integrated.

The procedure for overhauling PBY aircraft has always been cumbersome, but an assembly-line procedure has been devised which should materially expedite the work.

(7) Management Policies and Practices - Management practices which obviously require attention are:

(i) Although the Chief Engineer has cooperated in supplying the shops with technical information and advice, complaint is made that there is too much delay in doing so and that he is reluctant to reduce his decisions to writing;

(ii) Increases in stocks of parts in shop stores have expedited the overhaul of aircraft by making the parts more accessible to shop personnel; continued attention to such stocks is merited by the importance of them; and

(iii) Spoilage and waste of materials should be minimized and certain other practices eliminated. For example:

(a) New SNC fuel and other lines, valued at approximately $12,000, were used for other types of aircraft with the result that 90 percent became scrap. Although some use of these materials appears to have been justified by the inability of A&R to secure the proper ones, the Department continued to use them after it had obtained additional supplies of tubing instead of sending them on to the activities that still utilized the corresponding type of aircraft; similarly, templates for making SNC tubing were destroyed, although A&R is a manufacturing center;

(b) From May 16 to July 6, 1943, eight aircraft engines were carelessly burned up or otherwise damaged while being tested after overhaul. This costly damage seems to be attributable to inadequacy of management procedures as well as to the inexperience and carelessness of workmen. Obvious measures designed to prevent recurrence of such accidents have been recommended by the Intelligence Officer who investigates for sabotage;

(c) On April 23, 1943, the crew of a PBY, on a scheduled 6-hour flight over the Gulf of Mexico, noticed that the aircraft was not getting fuel from the starboard tank. It was able, therefore, to return safely to its base before the fuel supply was exhausted. Inquiry disclosed that the gasoline failure was attributable to the fact that a wooden plug had carelessly been left in the nipple of the starboard sump during overhaul in A&R and that this had not been discovered in two inspections and three beach tests. The incident was not called to the attention of the Intelligence officer for 28 days; and

(d) On several occasions employees in A&R made no adjustments on aircraft returned to it by the Flight Test Unit because they believed that the Flight Test Unit was trying to discredit their work by rejecting airplanes without adequate reason.

(8) "Cumshaw" - The manufacture and repair of things for A&R personnel with government labor and material, a practice known familiarly as "cumshaw", was prevalent prior to the reorganization of the Department in the fall of 1942.

On March 29, 1943, an order was finally issued prohibiting the practice and specifying penalties for civil and enlisted employees but omitting any reference to officer personnel. Whether they are justified in their conclusion or not, employees regard this as another example of the special treatment the officers accord themselves. In support of their reaction, they cite that a civilian was reduced in rating for making a set of bridle bits while no disciplinary action was taken against officers who had "swivel chair wings" manufactured. Although there appears to have been practically no "cumshaw" since the issuance of the order against it, a vacuum cleaner was recently repaired in the shops which employees believe to be the personal property of the A&R officer.

(9) Relation between A&R and Supply Department - A&R and the Supply Department have generally cooperated in procuring replenishment parts from outside sources and in distributing them within the station. Parts requested by A&R are usually received promptly, but there has been some delay in securing aircraft accessories because of failure to anticipate requirements accurately and to secure adequate stocks from major supply depots.

(10) Relation between A&R and Naval Bureaus and Offices - Certain difficulties have arisen which involve the dependency of A&R upon bureaus and offices of the Navy Department:

(1) A&R has been forced to overhaul some airplanes without blueprints because they were not received promptly from the Bureau of Aeronautics. Also, blueprints are received which do not contain manu-

facturers' local changes made in production. Plans have been formulated to expedite dispatch of accurate blueprints by microfilming them;

(ii) Mistakes and time losses are occasioned by the assignment by the Aviation Supply Office in Philadelphia of arbitrary stock numbers to standardized Army-Navy parts instead of assigning the AN part number as the stock number;

(iii) Material shortages, especially of bar stock and precision tools, have been the cause of delays and impeded operation; and

(iv) Confusion has been created in the shops and manhours have been lost as a result of Bureau of Aeronautics Circular Letter No. 42-41 and the corresponding letter of the Bureau of Supplies and Accounts requiring that A&R replace with Navy instruments defective Army instruments on Army airplanes used at the station. Much of the difficulty, especially with respect to air speed indicators, appears to have been attributable to failure to secure adequate stocks of Navy instruments from major supply points where they have been available. The Instruments Branch of the Bureau of Aeronautics has initiated a program to alleviate the difficulties encountered by overhaul bases in changing Army to Navy instruments.

b. Recommendations

On the basis of the foregoing findings and conclusions, it is recommended ~~that~~:

(1) The Navy Department take appropriate measures, including personnel and other changes, to insure that the civilian personnel policies of the Center and, particularly, of the Assembly and Repair Department of the Naval Air Station are in accord with those established by the Department. In this regard, the Personnel Relations Officer, recently appointed for the Center, might well be provided with such assistants, experienced in industrial personnel relations, as he may need in order to formulate and install a well-rounded, workable personnel policy and to effect a solution of the many difficult problems presently confronting the Center;

(2) Male officers and enlisted men should be relieved wherever possible when officer and enlisted WAVES are available as replacements;

(3) The housing agreement of the National Housing Administration, the Secretary of War, and the Secretary of the Navy should be abrogated, and housing should be provided for the naval personnel of the Center where private housing is inadequate;

(4) Provision should be made for reduction of the accumulation of materials and parts awaiting repair in storage;

(5) A survey should be made of the qualifications of officer personnel assigned to the Assembly and Repair Department, and those who are not qualified for their positions should be replaced as soon as possible by men who have had industrial production experience

and have previously supervised civilian employees;

(6) A similar survey should be made with respect to the qualifications of civilian supervisors in the Assembly and Repair Department and indicated changes should be made;

(7) Measures should be taken to assure civilian employees that supervisory positions will continue to be open to them on the basis of merit and will not be filled exclusively by naval personnel;

(8) The Assembly and Repair Department should be required to improve its personnel policies and administration and, in conjunction with the Personnel Relations Officer of the Center, to formulate a suitable personnel program, which should probably include;

(i) The designation of a well-qualified Shop Personnel Assistant who shall be free from routine duties in order to devote his entire time to important personnel matters;

(ii) Dissemination of accurate information regarding employment in the Department in order to counteract the circulation of misinformation;

(iii) Official notices relating to the rights of an employee and departmental policies;

(iv) Elimination of the practice of working employees in positions other than those for which they are classified for pay roll purposes, in compliance with a letter of the Assistant Secretary of the Navy, dated September 15, 1942;

(v) Improvement in procedures and administration of the efficiency rating system for civilian employees;

(vi) A promotion policy, based upon efficiency, value to the organisation, length of service since the last salary increase, etc., and designed to aid in retaining employees in the Department; and

(vii) Measures designed to foster an atmosphere of mutual effort and respect among all the personnel of the Department;

(9) With regard to absenteeism:

(i) Approval by the Navy Department of the employment of welfare workers to check employee absences and elimination of the requirement that employees be examined by the Medical Officer after they have recovered and returned to work;

(ii) Day nurseries and branch banking facilities be established, as suggested by A&R officials; and

(iii) The suggestion of the A&R Officer that prizes, such as War Savings Stamps or Bonds, be awarded to employees with perfect attendance records be considered by the Navy Department;

(10) A shop coordinator, selected on the basis of his knowledge of aircraft overhaul and repair procedures and his ability to work with others, be given ample authority to synchronise the production of the various shops of A&R;

(11) With regard to Assembly and Repair policies and practices:

(i) The Chief Engineer should be required to render and confirm his decisions promptly in writing;

(ii) A definite schedule should be established for frequent meetings of the Salvage Board so that critical materials and parts will not be allowed to accumulate;

(iii) The SNC tubing on hand in A&R should be forwarded to the Supply Department for transmittal to activities which utilize SNC aircraft;

(iv) The suggestions of the Intelligence Officer for preventing damage of aircraft engines and for improving inspection procedures in the Interim Overhaul Division be adopted;

(v) Measures be taken to insure that all adjustments to aircraft suggested by the Flight Test Unit are carefully made in A&R:

(12) Procedures be established for immediate notice to the Intelligence Office of any instance of unusual carelessness or neglect in the repair or overhaul of aircraft;

(13) A new order be issued relating to "gumshaw", specifically prohibiting the practice by officers as well as enlisted personnel and civilian employees; if work which might appear to be "gumshaw" is to be done in the shops, an appropriate explanation should be made to the employees performing the work;

(14) The Bureau of Aeronautics take the following action:

(i) Institute as soon as possible its program for microfilming accurate blue prints and for disseminating them promptly;

(ii) Cancel Bureau of Aeronautics Circular Letter No. 42-41 and expedite its program for procuring Army instruments for Army aircraft and for distributing instruments without waiting for requisitions from the field;

(iii) Provide for periodic inspection trips by representatives of the Instruments Branch of the Bureau to overhaul bases for the purpose of assisting in the solution of local problems; and

(iv) Provide for the assignment of Army-Navy part numbers as stock numbers by the Aviation Supply Officer;

(15) The Navy Department consider the authorization of elected employee representatives to an appeals board for the review of efficiency ratings at the Center; and

(16) Within 90 days after receipt of our report, the Commandant of the Naval Air Training Center forward a statement to the Secretary of the Navy with respect to the matters discussed herein for transmittal to this Subcommittee.

LYNDON B. JOHNSON

EXHIBIT A

ASSEMBLY & REPAIR DEPARTMENT ORGANIZATION

NAVAL AIR STATION, CORPUS CHRISTI, TEXAS

- A & R DISPENSARY & LABORATORY UNDER STATION MEDICAL OFFICER
- A & R OFFICER NAS
  - ASSIGNED ADDITIONAL DUTY AS A & R OFFICER, N.A.T.C.
  - EXECUTIVE ASSISTANT
    - ADMINISTRATIVE SECTION 101
      - CHIEF CLERK
      - FILES & RECORDS
      - CORRESPONDENCE
      - MAIL DESK
      - MESSENGER SERVICE
      - MIMEOGRAPHING
    - PERSONNEL SECTION 102
      - EMPLOYMENT
        - RECORDS
        - CORRESPONDENCE
        - TIME SECTION
      - VOCATIONAL TRAINING 104
        - SUPERVISOR & INSTRUCTOR
        - IN-SERVICE TRAINING
        - PRELIMINARY TRAINING
        - SUPPLEMENTARY TRAINING
        - E. M. TRAINING
        - SPECIAL TRAINING
      - ENLISTED PERSONNEL
        - RECORDS
        - TRAINING EDUCATION DISCIPLINE
        - BARRACKS
      - WAVES
      - SECURITY
        - WAR BONDS
        - ADDITIONAL DUTY AS E. M. WELFARE OFFICER
    - OFFICERS' RECORDS
    - ENGINEERING SECTION 103
      - ENGINEERS
      - DRAFTING
      - BLUE PRINTING
      - FILES AND RECORDS
    - PLANNING DIVISION 105
      - PLANT ACCOUNT 105
      - PLANNING 105
      - SCHEDULES 105
      - STATUS & RECORD 105
      - CHANGES 105
      - MATERIAL PROCUREMENT 106
      - MATERIAL SECTION 106
      - PROGRESS 107
        - LOST PARTS UNIT 107
        - OFFICE RECORD 107
        - TRANSPORTATION 110
        - SHOP STORES 120, 121, 122, 123, 124
        - CENTRAL TOOL ROOM 125, 126, 127, 128 Office
      - RECEIVING & ISSUING SECTION 130
        - REC. & ISSUING IN OVERHAUL CONTROL 206
        - REC. & ISSUING IN STRUCTURES 301
        - REC. & ISSUING IN ACCESSORIES 401
        - REC. & ISSUING IN MACHINE 501
        - REC. & ISSUING IN ENGINE O'HAUL 601
        - REC. & ISSUING FURNISHED TOOL PARTS IN AIRPLANE ASSEMBLY
        - REC. & ISSUING IN PLANT 801
        - REC. & ISSUING IN INTERIM O'HAUL 901
      - MASTER MECHANIC ASSIGNED DUTY IN PLANNING
    - COORDINATOR OF A & R AUX. AIR STATIONS
      - AUX. AIR STATIONS
        - ROOD
        - CABANISS
        - CUDDIHY
        - KINGSVILLE
    - PRODUCTION SUPERINTENDENT
      - OVERHAUL CONTROL
        - OFFICE 200
        - DISASSEMBLY 201
        - CLEANING 202
        - INSPECTION & ROUTING Parts Procurement 203
        - SALVAGE 204
        - PARTS IDENTIFICATION 205
      - STRUCTURES
        - OFFICE 300
        - FUSELAGE REPAIR 305
        - SURFACE REPAIR 306
        - FABRIC & RUBBER REPAIR 307
        - TANK SHOP 310
        - CABLE & TIE ROD 311
        - PAINT & DOPE 314
        - WINDSHIELD & COCKPIT ENC. 330
        - PLATING SHOP 331
        - PARACHUTES 332
      - ACCESSORIES
        - OFFICE 400
        - AIRCRAFT ELECTRIC & BATTERY 412
        - PROPELLERS 413
        - ELECTRICAL ACCESSORIES 414
        - RADIO SHOP 416
        - INSTRUMENTS 440
        - BOMBSIGHTS 441
        - ORDNANCE 442
        - OXYGEN & CO_2 443
        - PUMPS, STARTERS ETC. 444
      - MACHINE & METALS
        - OFFICE 500
        - SHOP PLANNING 502
        - LANDING GEAR SHOP 504
        - WELDING 541
        - DIE DESIGN 548
        - BLANKING 549
        - PATTERN SHOP 550
        - DROP HAMMER SHOP 551
        - TUBING SHOP 552
        - ALUMINUM MFG SHOP 553
        - STEEL FITTING SHOP 554
        - HEAT TREAT SHOP 555
        - MACHINE SHOP 556
        - SCREW MACHINE 557
        - COWLING 558
      - ENGINE OVERHAUL
        - OFFICE 600
        - DISASSEMBLY & CLEANING 630
        - OVERHAUL CONTROL 632
        - PISTONS 633
        - CYLINDERS 634
        - CRANKSHAFTS 635
        - NOSE & POWER 636
        - BLOWER & OIL PUMP 637
        - CARBURETOR 638
        - PAINT & METALLIZING 639
        - MACHINING SHOP 640
        - METALS & WELDING 641
        - IGNITION 642
        - ASSEMBLY 643
        - ENGINE TEST 644
        - PRESERVATION 660
        - MINOR OVERHAUL 661
        - AUXILIARY POWER UNITS 662
        - PARKERIZING & PLATING 663
      - ASSEMBLY & TEST
        - OFFICE 700
        - FLIGHT CONTROL INSTALLATIONS 717
        - FUEL & OIL SYSTEM INSTALLATIONS 718
        - FIXED EQUIPMENT INSTALLATION 719
        - ORDNANCE INST. 720
        - ENGINE SUB-ASSEMBLY & INSTALLATION 721
        - SURFACE INST. 722
        - GROUND TEST 723 FLIGHT TEST 724
        - FINISHED PARTS STOREROOM 770
        - COWLING SUB-ASSEMBLY & STORAGE 771
        - SURFACE SUB-ASSEMBLY 772
        - SMALL PARTS SUB-ASSEMBLY 773
        - COWL WINDSHIELD INSTALLATION 774
        - INSTRUMENT INSTALLATION 775
        - EMERGENCY REPAIR 777
      - PLANT
        - OFFICE 800
        - MACHINE MAINT. 890
        - ELEC. MAINT. 891
        - JOINER 892
        - JIG & FIXTURE 893
        - TOOL DESIGN & MANF. 894
        - INDUSTRIAL TRUCK REPAIR 895
        - JANITOR SERVICE 896
      - INTERIM OVERHAUL
        - OFFICE 900
        - HULLS 904
        - WING & SURFACES 905
        - COWLING 906
        - FLOATS 907
        - CLEANING & PAINTING 990
        - ENGINE & INSTR. INSTALLATION 991
        - ELECTRICAL INSTALLATION 992
        - PRESERVATION 993
        - MINOR REPAIRS & DISASSEMBLY PATROL PLANES 994
        - FINAL & SUB-ASSEMBLY CONTROL SHOP 995

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APPROVED
JANUARY 23, 1943
CAPTAIN USN
COMMANDING

EXHIBIT B

NAVY DEPARTMENT

SOSED-4-Md

April 30, 1936.

CIRCULAR LETTER

From: Secretary of the Navy.
To: All Naval and Marine Corps Activities concerned.

Subject: Uniform Efficiency Rating System.

References:
(a) Dept's cir. let. of September 17, 1925, SONYD-1-Kr, Subject, Uniform Efficiency Rating System.
(b) Dept's cir. let. of September 17, 1925, SONYD-1-Kr - Subject, Uniform Efficiency Rating System-Employee's Records.
(c) Dept's cir. let. of August 14, 1929, SONYD-7-Gn.
(d) Dept's cir. let. of September 14, 1929, SONYD-7-Gn.
(e) ALNAVSTA Six, 0609-1140, May, 1931.
(f) Dept's cir. let. of April 2, 1932, SONYD-4-Md.
(g) Dept's cir. let. of May 24, 1932, SONYD-4-Gr.
(h) Dept's cir. let. of August 26, 1932, SONYD-4-Gr.
(i) ALNAVSTA 0624-1236, June, 1933.

1. The uniform efficiency rating system and instructions with regard thereto, promulgated in references (a) to (i), inclusive, and certain additional instructions, are summarized herein, for the information and guidance of all concerned.

2. The following general rules will be followed for efficiency markings upon records of all civilian employees of the field service of the Navy Department:

(a) The efficiency rating of an employee gives his relative value in comparison with other employees of the same group performing similar duty.

(b) The efficiency rating is determined by averaging the marks obtained by the employee in four elements which are designed to cover those factors which indicate his value.

(c) A mark is given only for ease in arranging the personnel on a relative list; however, a mark of less than 65 will indicate that the person having

it is unsatisfactory in duties pertaining to the group in which he is assigned. Below is the normal variation in marks of a group of one hundred employees, based upon an average mark of 82.5:

3	-	95 to 100
7	-	90 to 94
20	-	85 to 89
40	-	80 to 84
20	-	75 to 79
7	-	70 to 74
3	—	below 70

(d) The mark assigned any employee under any of the headings prescribed below shall be determined by comparing his value with that of the average employee of the group to which he belongs. The mark assigned the average employee shall be between 80 and 85.

(e) The following four equal weight factors will be used in determining the employee's efficiency rating.

(1) Knowledge of trade or work. This will include general knowledge of all branches of his particular trade or work. Ability to plan work and read instructions. In case of supervisors, this must include also judgment, ability to grasp a situation and draw correct conclusions, sense of proportion of relative values, common sense.

(2) Quantity of work. This means rapidity with which work is accomplished; the quantity of work produced in a given time; the dispatch with which a task of known difficulty is completed. It includes also industry, diligence and application. In the case of supervisors, it also includes the ability of having work done with expedition; the orderly laying out of work in order to avoid loss of time in production.

(3) Quality of work. This includes accuracy, ability to produce work free from error, ability to detect errors; reliability in the execution of assigned tasks; dependability in following instructions; neatness and orderliness of work. In

supervisors, it includes the ability to lay out work in an orderly manner.

(4) Adaptability. This includes ability to work for and with others, the readiness to give new ideas and methods a fair trial, desire to observe and conform with the policies of the management. It also includes initiative and resourcefulness. In supervisors it includes also success in doing things in new and better ways; in adopting improved methods to the work in hand; leadership and executive ability, success in winning the cooperation of subordinates; self control, tact, courage; fairness in dealing with others.

3. Conduct is primarily a matter of discipline. It may be covered, however, for certain elements not warranting punishment, in the mark for "adaptability".

4. The term "group" is used advisedly in paragraph two, because in one case it may be the employees of one office; it may be the employees of one shop where all are of the same rating, or it may be a group of mechanics at the intermediate pay rate or a group of helpers. It is intended to have mechanics at the intermediate and minimum pay rates marked relatively by shops and by pay rates; thus a joiner at the intermediate pay rate from the woodworking shop would be given a relative standing with other joiners at the intermediate pay rate and might have a rating as high as that of the leader of the list of the joiners at the maximum pay rate. In the case of Group IV(b) employees, a competing group consists of all employees in the same classification grade, regardless of the title of position or rate of pay, in a major division of organization.

5. A central agency, designated by the commanding officer of each yard or station, will adjust all efficiency ratings (average of marks in the four efficiency elements) by some fair method in such a way that the average of each "group", exclusive of longevity credit, will eventually be between 80 and 85. This condition must be reached in order that the system may be entirely satisfactory. It is considered that commanding officers should handle this detail, probably by requiring the superintendents of each division or department to go over them first, then a central board, which would bring the efficiency ratings of the several departments to the same level.

6. The final rating shall be determined by adding to the efficiency rating a longevity credit of two-tenths of one point for each full year of Government service (including honorable service in the Army, Navy, Marine Corps or Coast Guard of the United States) for the first

five years, five-tenths of one point for each of the next two years, and one point for each year thereafter, except that the maximum credit for length of service shall not exceed ten points. Whenever retirement of employees with thirty years' service is authorized by law if involuntarily separated from the service such employees shall be given no credit for length of service. Such retirement is not now authorized by law. Longevity credit shall be excluded in determining whether or not employees are entitled to military preference.

7. Efficiency ratings of all employees shall be submitted to the commanding officer quarterly, except for Group IV(b) employees, whose efficiency ratings shall be submitted annually for the period ending May 15. In small shops or groups without fluctuation in regard to numbers, commanding officers may authorize markings semi-annually instead of quarterly. New employees should be marked monthly up to the end of the probationary period.

8. Recommendation for the administrative promotions of employees shall be in accordance with their efficiency ratings. Recommendation for separation of employees for lack of work or lack of funds shall be in accordance with their final ratings the laws, Executive Orders and regulations regarding veterans' preference, and the marriage clause in the Economy Act of June 30, 1932. In cases where there is a marked change in the efficiency rating of an employee, either upward or downward, from that previously submitted, notation shall be made of the reason for such change.

9. An employee whose efficiency rating is less than sixty-five shall be assigned, on trial, to work of a lower class, rating or grade, if his services are required in the reduced status; if not required, he shall be dismissed for inefficiency. In cases of employees appointed by the Secretary of the Navy recommendation for demotion or discharge shall be submitted to the De artments.

10. When an employee is transferred to another yard or station, his efficiency rating, final rating and relative standing on the list of his trade shall be sent to the yard to which he is transferred.

11. A "Report of Efficiency Ratings" shall be submitted to the Department annually, in duplicate, on N.Y.C. Form 107, for the year period ended May 15, covering all employees in Group IV(b) (including natives and aliens engaged on similar work) employed on that date, in time to reach the Department June 15. Employees paid from emergency funds shall be indicated by an asterisk and footnote. The names of employees shall be listed by major divisions of organization (Industrial

Department, Supply Department, etc.), and arranged thereunder by services (Subprofessional, Custodial, etc.), by grades (in reverse order), and under each grade in the order of efficiency ratings (in reverse order).

12. The title of N.Y.C. Form 107 is hereby changed to "Report of Efficiency Ratings", and the title headings of the columns changed as follows:

Column 2, change "final" to "efficiency".
Column 3, change "classification symbol" to "title of position".
Column 10, change "last service year" to "year period ended May 15".

/S/ W. H. Standley

Acting

Department distribution:
IV,V,VI,VII,VIII and IX.

EXHIBIT C

U.S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
Assembly and Repair Department

15 June, 1943

ASSEMBLY AND REPAIR DEPARTMENT ORDER NO. 52-43

Subject: Efficiency Ratings and Promotions Policy, - per diem employees.

References:
(a) A & R Basic Order No. 2, paragraph 6.
(b) A&R Basic Order No. 19.
(c) Appendix A, A&R Basic Order No. 19.

1. Effective immediately, all per diem employees (both War Service and Permanent), will be assigned efficiency marks each three months as follows: June 30, September 30, December 31 and March 31. War Service employees employed less than a year will be assigned efficiency marks each month until their trial period has elapsed, which is a period of one year.

2. Promotions are based on the relative efficiency marks and are to be made from the top of individual groups. Recommendations for promotions may be submitted to the A&R Officer for approval only each three months, on July 10, October 10, January 10 and April 10, and shall be based on the latest Quarterly efficiency report.

3. The only exception to the rule that promotions be made from the top of the efficiency group is in the case of an employee being recommended for reallocation to another trade or type of work when qualified.

4. The exception to the rule that promotions be made other than every three months are as follows:

(a) Classified Laborers performing duties as Laborers, who are employed at intermediate rate of pay, may after a trial period of 30 days be promoted to maximum rate of pay.

(b) Classified Laborers assigned to the Vocational Training Division, employed at intermediate rate of pay, may after a trial period of 30 days be promoted to Mechanic Learner. When Mechanic Learners have successfully completed the Vocational Training course, they will be promoted to a Helper rating at the minimum rate of pay.

(c) Classified Laborers employed to perform duties as Chauffeur may, after a trial period of 30 days, be promoted to Chauffeur, minimum rate of pay.

Subject: Efficiency Ratings and Promotions Policy, - per diem employees.

- -

5. The following yardstick is to be used in determining the number of employees to be recommended for promotion from the top of the efficiency list of helper, and mechanical employees:

(a) All employees receiving an efficiency rating of 82.5 or above may be considered for the next higher rating, depending on the amount of work required of the department and the available funds.

(b) All employees receiving a rating between 82.5 and 70.0 will remain in their existing rate until such time as their efficiency rating has been improved to 82.5 or above.

(c) Employees whose relative efficiency rating marks are below 70.0, but not below, 65.0, are to be warned, in writing, giving reasons for the low mark, that unless the unsatisfactory work or actions are corrected they will be subject to reduction or discharge when the next efficiency report is issued.

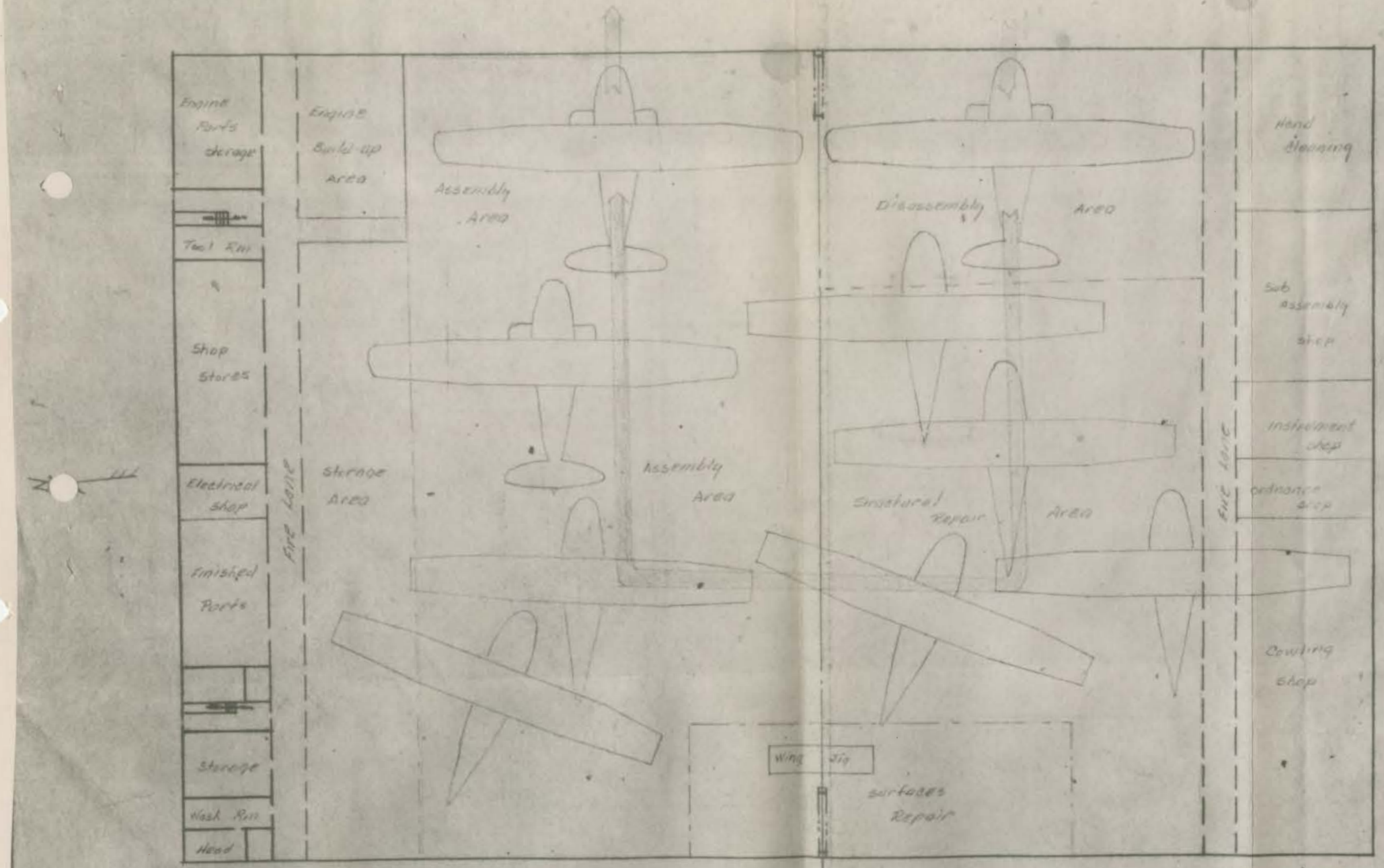
(d) An employee whose relative efficiency rating is less than 65.0 shall be assigned, on trial, to work of a lower class, rate or grade, if his services are required in the reduced status; if not required, he shall be dismissed for inefficiency.

6. References (a) through (c) are hereby amended wherein they differ from the instructions outlined herein.

/s/ N. F. GARTON

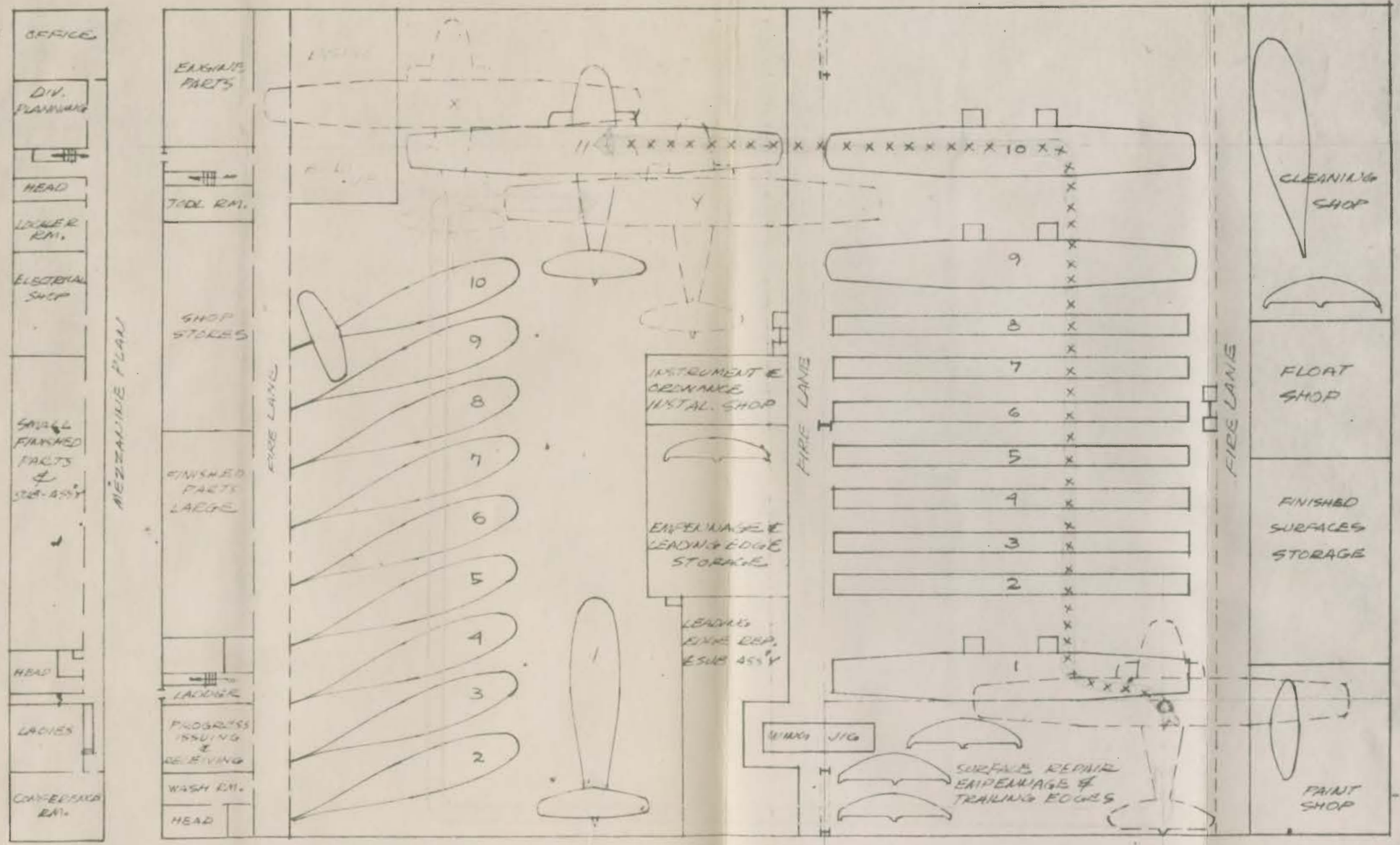
N. F. Garton,
Lt.Comdr. U. S. N.,
Assembly and Repair Officer.

EXHIBIT D



PRESENT LAYOUT

EXHIBIT E



PROPOSED LAYOUT

NA47/L8-3/N5(A&R)
HNE:gm(ab)70-101

EXHIBIT F

HNE:(gm)14-101

To: The Chief of the Bureau of Aeronautics.
Via: The Commandant, NATC, Corpus Christi.

Subj: Project Order for procurement of additional shop equipment for the Assembly and Repair Department - request for.

Ref: (a) BuAer ltr. Aer-PR-432-JA N5/NA47 dated 2-23-43.
(b) BuAer ltr. to BuDocks Aer-NA-3112-EW NA47 (1) 30213 dated 3-2-43.
(c) SecNav ltr. P&200 CAJ:hje P&1104 1039 dated 11-4-42.

1. Due to the expansion and increased work load of the Assembly and Repair Department and the urgent need of machine tools and equipment it is requested that a project order be authorized for this station in the amount of $95,000.00 to purchase additional machinery and shop equipment as shown on enclosure (A). This machinery and shop equipment is in addition to that authorized in reference (a). The equipment listed in enclosure (A) for the Foundry and Drop Hammer shop is in addition to that authorized in paragraph 3A of reference (b).

2. It is further requested that when the project order is established this Station be authorized to prepare procurement specifications and to make purchases locally through negotiated contracts where desired, and that the project order be established under the heading, "Equipment for the Assembly and Repair Shops".

3. The policies and criteria outlined in reference (c) have been given full consideration. The equipment requested is necessary and is in accordance with the policies of the Navy Department.

Encls.
(A) (RW) List of additional shop equipment. (2 copies)

ADDITIONAL MACHINERY AND SHOP EQUIPMENT REQUIRED

ITEM NO.	SHOP NO.	AMT	DESCRIPTION	APP. COST
1	103	1	AB-Standard Polisher, 3/60/110 AC, 575-1150	$ 143.50
2	107	1	Tag Embossing Machine, Planer No. 4, Power Drive	600.00
3	201	1	Press, tag, power, floor type, Perkins	1,300.00
4	307	2	Machine, Sewing, Singer, #11-W-152	850.00
5	307	1	Machine, Sewing, Singer, #16-188	250.00
6	307	2	Machine, Sewing, Singer, #111-151, complete	820.00
7	310	1	Router, Industrial, hand, portable Onshrud, WD-1	75.00
8	320	1	Drill Press, bench type, ½" Chuck 17" Delta	188.75
9	416	1	Drill Press, 14", ½", ½ H.P. Delta	177.50
10	440	3	Drill Press, sensitive, ½" capacity, Bench type	360.00
11	554	2	Drill Press, Sle-Speed, Boice Crane, No. 2610	280.00
12	722	1	Drill Press, bench type, ½" capacity	188.75
13	894	1	Drill Press, ½" capacity, floor type	188.75
14	414	40	Lamps, Dazor, floating, 24" arm, P-2124-16	770.00
15	556	24	Lamps, Dazor, Universal, 34" arm est.	468.00
16	553	1	Press Brake, hand, Whitney Jensen #247	150.00
17	553	1	Slip Roll, hand, Pexto, No. 0350	70.50
18	553	1	Saw, Do-All, 26" throat	2,600.00
19	900	1	Saw, Do-All, 26" throat	2,600.00

ENCLOSURE (A) Sheet 1 of 4 pages

ITEM NO.	SHOP NO.	AMT	DESCRIPTION	APP. COST
20	551	1	Press, Housing type semi-automatic plastic molding 75 tons, Elmes	5,000.00
21	555	2	Furnace, heat treat, tool room, Lindburgh, 0-1250	6,000.00
22	555	1	Furnace, box electric, Resistor, C. I. Hayes, 38-WK-0-1850	3,200.00
23	555	1	Oven, electric baking, Acme type 27-85671, 220 Volts, 600 Watts	450.00
24	556	1	Grinder, Lathe, precision, Dumore, #5 with quills for internal grinding	242.50
25	556	1	Grinder, Lathe, precision Dumore, #7 with quills for internal grinding	284.75
26	642	2	Lathes, speed type NALE, 3-Speed, Frame 17	895.00
27	554	1	Turret Press, Wiedeman B-A, with punches	3,150.00
28	550		Miscellaneous, template, layout tools and equipment	1,900.00
29	550	1	Sander, spindle, 7/8-2" sleeves and acc's.	128.90
30	892	1	Belt sander, portable, 4½" belt, and accessories	120.00
31	892	1	Sander, portable disc. type, 7" and attachments	92 .00
32	632	21	Dial Indicators	349.00
33	632	1	Mechanical parts cleaner, model K.S. 10-1 8 x 24"	96.50
34	722	1	Grinder, bench type, 6" wheels, 110 volts	115.00
35	894	1	Grinder, Lathe, Dumore, precision No. 7A with quills for internal grinding	284.75
36	894	1	Cylindrical grinder, Norton	4,320.00
37	894	1	Tool and Cutter grinder, Oliver Ace 1/2 H.P.	1,020.00

ITEM NO.	SHOP NO.	QUANT.	DESCRIPTION	APP. COST
38	894	1	Dividing Head, wide range, Cinn. Div. 2 to 400,000	$ 350.00
39	893	1	Oxygraph, Airco, model 6-A and equipment	2,380.42
40	894	1	Rotary table, Pratt and Whitney, 20"	1,240.00
41	894	2	Vises, toolmakers, Universal, Brown and Sharpe	286.00
42	895	1	Truck, low platform, 4,000#	2,750.00
43	894	1	Shaper, 24" Cincinnati	5,200.00
44	904	1	Shears, squaring, 16 gage, 4' Pexto	400.00
45	556	1	Milling Machine, 3K Universal, Milwaukee, with attachments	6,781-80
46	414	1	Bench type Milling Machine, Pratt and Whitney	1,200.00
47	556	1	Machine, screw, automatic 1" capacity, single spindle (Cleveland)	8,000.00
48	556	1	Machine, screw, automatic 1/2" capacity, single spindle, Brown and Sharpe	6,300.00
49	644	2	Plate, Dynamic Suspension, Engine Test Stand, Jacobson & Company Dwg. #20694	1,134.00
50	644	3	Mount, Tubular Engine Test Stand, Jacobson & Company Dwg. #20722	1,434.00
			Sub Total	$77,184.37

EQUIPMENT FOR FOUNDRY AND DROP HAMMER SHOP

51	551	1	300# capacity, maximum, non-ferrous, gas fired tilting type melting furnace	$ 550.00

ITEM NO.	SHOP NO.	ART.	DESCRIPTION	APP. COST
52	551	1	Zinc furnace, hydraulic tilting type, gas fired, capacity approximately 8½ cu. ft., with blowers, controls, pumps and automatic safety cutouts	$4,300.00
53	551	1	Lead furnace, hydraulic, tilting type, gas fired, capacity approximately 5 cu. ft., with blowers, controls, pump and automatic safety cutouts	4,300.00
54	551	2	2 ton, bull ladles, V-type, helical geared, enclosed	750.00
55	551	12	Steel flasks, size 12" x 12" x 5"	600.00
56	551	12	Steel flasks, size 18" x 18" x 5"	660.00
57	551	3	Riddles, motor driven, Foundry, portable	540.00
58	551	2	Heavy duty metal cutting band saws, 30" Tenowitz	3,600.00
59	551	1	Stock core machines, 1/4" to 3", Wadsworth	320.00
60	551	1	Forge, open type, gas, Mahr.	110.00
61	551	1	Forge, closed type, gas, Mahr.	135.00
62	551	2	Ladle heaters, gas	80.00
63	551	3	Grinders, Die, Pneumatic 15000 R.P.M. with miscellaneous formed finishing attachments	400.00
64	551		Miscellaneous hand tools and equipment	790.00
			Sub Total	$17,135.00
			GRAND TOTAL	$94,319.00

ENCLOSURE (A) Sheet 4 of 4 pages

EXHIBIT G

Aer-E-338-MER
F31
0811.29

NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

CIRCULAR LETTER NO. 42-41

From: The Chief of the Bureau of Aeronautics.
To: All Ships, Stations and Units Concerned with Aircraft.

SUBJECT: Aircraft Instruments - disposition of.

1. The Bureau of Supplies and Accounts recently issued a letter which is considered of sufficient importance to reprint verbatim as a Bureau of Aeronautics Circular Letter.

(a) "Inasmuch as the Air Corps has in use a number of standard Navy instruments and the Navy has in use a number of standard Air Corps instruments, the return of defective Navy instruments to the Navy and of defective Air Corps instruments to the Air Corps has been approved. Therefore, a defective standard Air Corps instrument in use by the Navy should be replaced by a standard Navy instrument, and a defective standard Navy instrument in use by the Air Corps should be replaced by a standard Air Corps instrument inasmuch as no facilities are available to repair defective Air Corps instruments at Naval Activities or vice versa."

2. If the mounting dimensions of Navy and corresponding Air Corps instruments differ, it is requested that the instrument cutouts be modified to accommodate the Navy instrument replacing the defective Air Corps instrument. If connections differ, they should be modified in accordance with the installation, operation and maintenance instructions packed with the Navy instrument, the Handbook of Aircraft Instruments, Specification SR-74-A, and Bureau of Aeronautics wiring diagrams.

3. Field requisitions for Air Corps instruments should not be submitted unless there is no Navy instrument which can be considered as an acceptable substitute.

D. C. RAMSEY
Captain, U. S. N.,
Assistant Chief of Bureau.

EXHIBIT H

V. Changing Army to Navy parts.

A. Instruments.

1. Applicable orders are attached.

2. If Bulletin #8 if fully incorporated, all Army instruments are replaced with Navy, except the Fuel Quantity Float Gauge, in which there is no Navy replacement.

The main reason for trouble here is the modification that has to be made on the panels, both front and rear. The cut-outs for the Altimeters, Rate of Climb indicators and Aircraft Clocks have to either be filed or cut out to fit the Navy type instruments. The compass screw holes on the panels are supposed to be welded shut for reinforcement, but difficulty is presented here due to the fact that 24 S. T. Aluminum alloy cannot be welded and instead, a metal plate must be inserted to cover the screw holes. On the rear panel, trouble arises because the bracket necessary for the installation of the Navy type Compass protrudes from the panel, interfering with safety angles because the Compass forms two sharp edges and if the plane should come to a sudden stop, it might result in severe injury to the pilot. Another problem is that the compass may interfere with a pilot's parachute in the event it becomes necessary that he "bail out".

Much time is lost in exchanging Army instruments with Navy at the Supply Department.

Approximately three hours are spent in making all the necessary papers for exchange. The storekeeper spends about 30 minutes making the changes and 30 minutes, at least, are lost in transportation. Routine work is disrupted in having the Navy instruments checked for accuracy and some have to be repaired again due to careless handling in transportation or while in storage. Time is lost also in checking in and out of the Navy type instruments. The panels must be routed to three different shops for modification and painting. In several instances they have been lost in transportation.

In replacing Army electrical instruments with Navy type, much time is lost due to the change necessary in writing. This will be fully explained later in this report.

Many hours in production time are lost in repairing Army instruments in the shop. This is due to the inability to procure parts for their repair.

This necessary repair is due to the fact that squadrons of the Station are not equipped to make changes necessary in replacing Army instruments with Navy. The defective Army instrument is sent to the Assembly and Repair Department for repair and the plane the instrument came from is either grounded at the squadron or a spare Army instrument (which is obtainable only through salvage) is placed in the plane.

In changing Army Electrical Tachometers (or Mechanical) to Navy type (Electrical), a bracket is necessary to house the generator and it must be placed on the cowling or engine brace. This is also a case where a change in wiring is necessary and few squadrons, if any, are equipped to do this work. Wiring changes are made in replacing the following instruments.

(a) Electric Tachometers from Army type E-12 to Navy type NK V.F.S.C #88-I-2500
   (1) Tachometer Generator from Army type to Navy F.S.S.C #88-G-1375.

(b) Free Air and Carburetor Air Temperature Gauges from Army type F-9 and C-12 respectively to Navy type F.S.S.C. #88-I-2850 (Navy Carburetor Air and Free Air are identical).

(c) Cylinder Temperature Gauges from Army type C-9 to Navy type F.S.S.C #88-I-2650.

(d) Engine Gauge Units from Army types C-7 to Navy electric type F.S.S.C. #88-U-300.

When Army electrical instruments, if no replacements are available in Supply, are sent to the Assembly and Repair Department for repair it is known that the instrument must be repaired or some replacement found. The instrument is disassembled, cleaned, inspected and if any part needs to be replaced, it must either be manufactured or salvaged from another instrument. If neither of these channels are open, the instrument is reassembled and returned to the Squadron. Much time is lost in this routine through routing of the instrument to Assembly and Repair and back to Squadron. However, the most critical time is lost in instrument disassembly, inspection, and reassembly. This condition

could be relieved by stocking Army spares or spare parts for their repair.

Local Change #110 is being incorporated on instrument flying Aricraft only. The order states that Squadron personnel shall incorporate this change, but the change is incorporated at the time of the first major overhaul.

This above change causes less trouble than any of the others. The trouble caused in this case is slight and is due to squadrons not incorporating the complete change. Some ships arrive for major overhaul with merely the Manifold Pressure Gauge installed and the Army type tachometers still in the aircraft. If this condition is not noticed upon disassembly, production time may be lost in having to complete incorporation of the change after the ship reaches final assembly.

This confusion is caused by the change being incorporated on instrument flying aircraft only.

Local Technical Order 6-43 causes some confusion together with loss of time in replacing Army carburetor temperature gauges with Navy types.

Confusion here is caused by the fact that Army free air temperature guages and carburetor air temperature gauges are entirely different as the exterior views of the instruments are concerned. These two instruments are easily recognized as being different, whereas the Navy replacement for the two Army instruments is the same instrument. This necessitates the manufacture of a nameplate designating one Navy replacement as a free air temperature gauge and the other as a carburetor air temperature gauge.

In incorporating L.T.O. 20-43 there is little confusion within the change. This L.T.O. would not be necessary if the Army adapters could be procured efficiently by the Navy. The Navy department previously has equipped this Station with these adapters solely by allocation which has not previously been sufficient.

The impairment caused by this change is of a material standpoint. The flexible drive shaft required is a Stearman type as used on N2S-1, N2S-2, and N2S-3. The availability of these flexible drive shafts has been

poor. The brackets must be manufactured locally and other equipment necessary for the change has been scarce in the squadrons. The change as a whole, not considering the time spent in procuring the necessary materials, takes approximately two hours.

L.T.O. 25-43 was necessitated by the fact that the Navy procured aircraft on Army contract. All Army airspeed indicators are calibrated in miles per hour upon initial installation. In replacing these indicators, as instructed in Bureau Circular Letter 42-41 of 18 December, 1941, when the Army indicator became defective, much concern was raised over the fact that indicators in one plane would conflict because one would be in knots and one would be in miles per hour. Concern then was caused when planes flying formation would be made up of some planes flying with calibrated instruments in knots and some calibrated in miles per hour.

This resulted in the requirement that "M.P.H." or "KNOTS" be painted on the glass of the instrument. After this was done confusion in different squadrons flying these Army contracted planes was still great and the need of standardization of these instruments was noticed. This brought about Local Technical Order #3-43 (which has since been superseded).

This in itself was confusing enough for many reasons. All Army instruments would have to be exchanged at Supply for Navy. This soon depleted the stock of Navy instruments in Supply. Assembly and Repair was overloaded at the time with a heavy overhaul schedule and it was soon found that the stock of airspeed indicators calibrated in knots was not nearly large enough to take care of replacements in all Army aircraft. Due to this shortage it was found necessary to release L.T.O. 25-43. This order enabled the squadrons to continue operating.

Confusion felt in the Assembly and Repair was caused by the fact that all the Army instruments calibrated into knots previously would have to be recalibrated to miles per hour and also Navy instruments used in Army aircraft, as replacements, would have to be calibrated into miles per hour. There is, on this Station, only one type of Navy Airspeed Indicator that can be calibrated in miles per hour, i.e., the U.S.Gauge, F.S.S.C. #38-I-325. Confusion now in the Assembly and Repair is caused by squadrons sending Navy Airspeed Indicators to the Assembly and Repair Department for calibration to miles per hour. These indicators (U.S. Gauge), as a whole, are extremely hard to calibrate from knots to miles per hour. It is estimated that

two out of five (U.S.Gauge) indicators cannot be calibrated accurately. Calibration requires from 3 to 8 hours' time.

On SNB-1 aircraft, now being used on this Station for training purposes, two instances arise where replacement is difficult. First, the replacement of the Pitot Static Tube. No Navy type static tube will function in the same position as the original type. Before a change can be incorporated, tubing must be installed to the wing tips, and therefore the installation of Navy type static tube has been deemed inadvisable. The Bureau supplied this station with eight original type Pitot Static Tubes.

The Army and Navy Drift Sights are entirely different in function, size and weight. The Navy Drift Sight operates on a suction basis, whereas the Army type is electrically propelled. The Navy instrument is much larger than the Army and is considerably heavier. This instrument is practically impossible to replace with Navy type as the floor will have to be redrilled, electrical wiring taken out and tubing replaced. The entire system of the Drift Sight would have to be changed. Both of the above problems have been estimated as requiring one week's work.

This station has also been unable to obtain replacements of spare parts for this Army Drift Sight.

Replacements of Fuel Air Ratio Indicators on JRB airplanes is not possible. In other Army contracted aircraft in use by the Navy, the Bureau has requested their removal with no replacement necessary.

In SNB-1 aircraft, when the dual Army Cylinder Temperature Gauge becomes defective, two Navy indicators are installed. One where the defective instrument was and the other replaces the Fuel Air Ration Indicator.

Other Army instruments that cannot be replaced with Navy type are the Fuel Quantity Gauge Floats on SNV-1, SNJ-3 and SNJ-4 airplanes which have been mentioned before. Our source of these replacements is solely from salvage aircraft.

3. At the present moment, the status of availability of Navy instruments replacing Army instruments is not especially critical. At various times in the past,

in order to complete the overhaul of an airplane, it has been necessary to assign an instrument from one plane to another. This is the necessary procedure not only for instruments but for any other type of part or material, in order that the plane which is almost completed will not be delayed because of the need of a part which is available on an airplane due for completion at a date in the future. The Assembly and Repair Department, in the handling of stock replenishment lists, orders instruments and instrument parts for this Naval Air Training Center. As the experience relative to percentage replacements broadens, it will be possible to make more accurate estimates of needs. Necessarily, changes, improvements and special conditions which may arise affect the estimates made. The ratio of Navy instruments to Army instruments on hand is not entirely satisfactory. Efforts are being exerted as far as possible toward correction of this situation. It is apparent that Army instruments have been allocated to this Station but the correspondence is confidential. In view of the fact that the instruments used in Army contracted airplanes are all mechanical with the exception of one, these instruments will not cause grounding of aircraft because of their lack, as operating squadrons are capable of incorporating the necessary change. Necessarily, all parts salvaged from instruments damaged beyond repair are made available for the repair of other instruments as they are turned in to the shops.

4. Rather than single out each instrument to be changed from Army to Navy, it may be better to explain it in this manner.

In wiring changes alone, not taking into consideration the time necessary to repair the instruments or in exchanging them, the following estimate has been made.

(a) Changing wiring to replace Army Tachometers with Navy. . . . . 2 hrs.
(b) Changing wiring to replace Army Engine Gauge Units. . . . . 6 hrs.
(c) Changing wiring to replace Army Carburetor Temperature Gauge . . . . . 2 hrs.
(d) Changing wiring to replace Army Free Air
(d) Temperature Gauge. . . . . 2 hrs.
(e) Changing leads to replace Army Cylinder Temperature Gauges . . . . . 1/2 hr.

In making changes on panels to fit instruments being changed from Army to Navy, the following estimates are given:

(a) In changing the Army Compass to Navy in the front cockpit, including insertion of metal plate for security . . . . . 3 hours.

(b) In changing the Army Compass to Navy in the rear cockpit, including manufacturing time of the bracket . . . . . 4 hours.

(c) In changing Army Clock to Navy by filing new cut-outs in panel (both cockpits). . . . . .45 minutes.

(d) In changing Army Manifold Pressure Gauge to Navy (front cockpit) : . . . . . 30 minutes.

(e) In changing Army Rate of Climb to Navy (both cockpits) . . . . . 45 Minutes.

(f) In changing Army Altimeters with Navy (both cockpits). . . . . 45 minutes.

(g) In changing Army Tachometer Generator with Navy (Installation of bracket). . . . . 30 minutes

In changing the pitot tube, from Army to Navy, on SNB-1 aircraft, it is estimated the total change would take approximately 80 to 90 man hours.

In changing the Drift Sight from Army to Navy on the same plane, it is estimated that 100 man hours are required.

The amount of time indicated is over and above any time required to check and repair an instrument.

5. Navy instruments are made of no better material than Army instruments. Their construction is similar. However, for the most part, Army instruments are better constructed than are the Navy instruments. This is noticed mostly in Navy instruments of low cost and of standard make.

Army instruments are more precise and exact and are more efficiently made than Navy instruments, therefore, offering a smaller amount of time necessary for overhaul.

6. Army instruments that have been replaced with Navy are returned to Supply in an unrepaired status for disposition. Each of these instruments, when beyond repair at this Station, are tagged as such with statement "Return to Army" on them.

V.

B. Other Parts.

1. It is found that Army and Navy instrument parts are not interchangeable on instruments of low cost, and this practice has never been known to exist in this department, except that in some cases Navy Capillary Tubes were inserted in Army mechanical Engine Unit Gauges, type C-7, when defective Navy instruments were not available for repair.

On instruments of precision, such as Sperry Gyro instruments and Pioneer Turn and Bank Indicators, the parts are completely interchangeable and are repaired in this department as if they were standard Navy instruments.

NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

Refer to No.
Aer-E-337-JW
W-535
AC-15569
018776

28 February, 1942

From: The chief of the Bureau of Aeronautics.
To: The Commanding Officer, Naval Air Station,
Corpus Christi, Texas.

SUBJECT: Contract W-535-AC-15569 - Vultee Aircraft Incorporated - Model SNV-1 Airplanes - Government-Furnished Instruments - Shortage of.

References:
(a) GINA, Dayton, ltr. VSNV/(4749) dated 18 December 1941 with BuAer 1st Ind. Aer-PED-24-LH W535-ac-15569 dated January 1942 and NAS, Corpus Christi, ltr. NA47/F1-4, L5, 13/HB/etg dated 5 February 1942.
(b) Bu S&A ltr. ES9/A2-2(SSL), L8-2/EW dated 28 Nov. 1941.
(c) BuAer Shipment Order No. 3629 of even date.

1. Reference (c) was issued to cover the shipment of standard Navy instruments to be installed in the place of those standard Army Air Corps instruments which in reference (a) were reported to be missing in the Model SNV-1 airplanes. The Navy does not stock any selector valve which can replace the Static tube selector valve used in the Model SNV-1 airplanes.

2. The Army Air Corps tachometers installed in the Model SNV-1 airplanes are not interchangeable with the standard Navy electric tachometers. The Army tachometers should be removed from 33 of the 65 model SNV-1 airplanes reported in reference (a) to have only one tachometer indicator and a complete installation of standard Navy electric tachometers should be made. The tachometer indicators removed from the 33 airplanes should be used to make up the missing indicators in the remaining 32 Model SNV-1 airplanes. The excess generators should be retained for replacement purposes.

3. Since the Navy does not require an alternate static pressure source, it is requested that the static pressure line of the pitot-static tube be connected in such a manner that the static tube selector valve is eliminated on the 6 Model SNV-1 airplanes reported in reference (a).

4. Since the Navy does not require the installation of two engine cylinder thermometer indicators in VSN type airplanes, no action will be taken to supply these thermometers for airplanes reported in reference (a).

5. The remaining items shown in the second endorsement of reference (a) will be handled by separate correspondence.

/s/ D. S. FAHRNEY,
Commander, U.S.N.,
By direction Chief of Bureau.

CC: GINA

NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

Aer-E-3314-MRV
F31
F31-3(11)
QM(6428)

15 June 1943

91304

FROM: The Chief of the Bureau of Aeronautics.
To: The Commanding Officer,
Naval Air Station,
Corpus Christi, Texas.

SUBJECT: Gyro Instruments - Jack & Heintz - Repair of.

References:
(a) NAS, Corpus Christi, ltr. NA47-F31-1, 19 SC-ce, dated 11 May 1943.
(b) BuAer Circular ltr. No. 42-41, dated 16 December 1941.

1. In reply to reference (a) the gyro instruments manufactured by the Jack and Heintz Company and installed in Navy airplanes received from the Army Air Forces are to be repaired by Naval overhaul activities. Spare parts for these instruments are obtainable upon requisition from the Aviation Supply Officer, Naval Aircraft Factory, Philadelphia, Pennsylvania, in complete kits sufficient for the overhaul of 100 instruments, and complete kits, rather than individual parts, should be requested. Parts not contained in the kits will not be furnished. Instruments requiring parts not furnished with kits should be repaired with salvaged parts where practicable or the instruments requiring them used as a source of salvaged parts.

2. Parts lists for the subject instruments should also be requested of the Aviation Supply Officer at Philadelphia.

3. Action to amend reference (b) to provide for the repair by Naval facilities of certain instruments received in Army airplanes delivered to the Navy is being coordinated with the Army Air Forces. Although the final policy has not yet been determined, it is anticipated that all gyroscopic flight instruments received in airplanes delivered to the Navy from the Army will be overhauled by Naval facilities.

/s/ L. WOLFE
L. Wolfe
Comdr., USNR
By direction Chief of Bureau.

14-31 (ET)

U. S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
Assembly and Repair Department

15 March 1943

LOCAL TECHNICAL ORDER NO. 20-43

SUBJECT: Model SNJ-3, -4 Airplanes - Tachometer Generator - Installation of.

References:
(a) Local Technical Order #17-43.
(b) A&R Dept. Dwg.#284.

1. Reference (a) is cancelled and superceded by this technical order.

2. Purpose:
To permit installation of tachometer generators in Model SNJ-3, -4 airplanes when the Type A-5 (Specification 94-27831) 90° adapters are not available.

3. Application:
This order is applicable to all model SNJ-3,-4 airplanes at this Training Center.

4. When Change is to be Made:
As required when Type A-5 adapters are not available.

5. Description:
This change consists of replacing the 90° adapter with a flexible drive shaft and attaching the tachometer generator to the upper right engine mount leg in accordance with the details shown on reference (b).

6. Parts Removed:
Type A-5 adapter (Specification 94-27831).

7. Parts Added:
Flexible drive shaft (See S.S. White Dental Mfg. Co. Dwg. #2510-Y).
Bracket (See reference (b).

8. Weight and Balance Involved:
The effect on the weight and balance of the airplane is considered to be negligible.

9. Source of Necessary Material:
Necessary parts shall be of local manufacture.

Approved: N. F. Garton, Lt. Comdr., USN, Assembly and Repair Officer.

D. A. Wrigley, Lieutenant, USNR, Chief Engineer.

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VN16D8 (2)
VN Unit
Bureau of Aeronautics (3) with ref.)b)
NAS Dallas (2) with ref. (b)
NAS Seattle (2) with ref. (b)
NAS Pensacola (2) with ref. (b)

14-31

U. S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
ASSEMBLY AND REPAIR DEPARTMENT

29 March 1943

LOCAL TECHNICAL ORDER NO. 25-43

SUBJECT: Calibration of Airspeed Indicator.

Reference:
(a) NAS Corpus Christi LTO #3-43 of 16 January 1943.

1. Reference (a) is cancelled and superseded by this order.

2. Airspeed indicators shall henceforth be calibrated as received from the contractor; i.e., indicators on Air Force contract aircraft shall be calibrated in miles per hour, indicators on naval contract aircraft shall be calibrated in knots.

3. Calibration by the instrument shop shall be as follows:

(a) All Air Force instruments shall be calibrated in miles per hour

(b) All Navy instruments shall be calibrated in knots except

1) Navy instruments installed in Air Force aircraft as replacements shall be calibrated in miles per hour. The ratio of knot and miles per hour indicators calibrated shall be specified by the Planning Division.

4. Squadrons operating Air Force contract aircraft on which replacement or overhauled indicators calibrated in knots have been installed, shall exchange these indicators for mile per hour indicators as units become available.

W. F. Carton,
Approved: Lt. Comdr., USN,
Assembly & Repair Officer.

D. A. Wrigley,
Lieutenant, U.S.N.R.,
Chief Engineer.

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U. S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
Assembly and Repair Department

16 January, 1943

LOCAL TECHNICAL ORDER No. 3-43.

SUBJECT: Airspeed Indicators-Calibration in Knots.

1. All airspeed indicators returned to this department for repair or overhaul shall be calibrated in knots in lieu of miles per hour. Spare indicators shall be drawn from Supply and be recalibrated before issue.

2. Arrangements shall be made with the Planning Superintendent by operating units desiring modification before overhaul.

R. A. Wrigley,
Lieutenant, U.S.N.R.,
Chief Engineer.

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NAS-CC-IX:4:4 18 April, 1942

A & R Dept Manual: VII-1 DAW Eng. Inst. #60-42

U. S. NAVAL AIR STATION CORPUS CHRISTI, TEXAS
ASSEMBLY AND REPAIR DEPARTMENT
ENGINEERING INSTRUCTIONS NO. 60-42

SUBJECT: Model SNJ-2 and SNV-1 Airplanes - Removal of Government Furnished Instruments.

REFERENCES:
(a) Buaer ltr. Aer-E-337-JW, W-535, AC-15569 - No. 018776, dated 23 February, 1942.
Buaer ltr. Aer-E-3320-1D8, VSNJ-3/FS1, VSNV-1/FS1.

1. Since the Army Air Corps Tachometers installed in Model SNC-1 airplanes are not interchangeable with the standard Navy electric tachometers, the Army tachometers shall be removed from 33 of the 65 planes having but one tachometer indicator in order to complete the installation on the 32 remaining planes with one indicator missing. The excess generators and indicator will be kept for spares. A complete installation of standard Navy tachometers shall be made in the 33 planes from which the Army tachometers were removed.

2. On all SNV-1 Airplanes which have a static tube selector valve, the static pressure line of the pitot-static installation will be connected in such a manner that the static selector valve can be eliminated when not in operation. Replacement is not required.

3. On all the subject airplanes which are not being used for instrument training the directional gyro and the gyro horizon will be removed from the rear cockpit and turned in to supply for further disposition as directed by the Bureau.

4. The above work shall be accomplished as soon as possible without interruption of operations, or at the first overhaul.

D. A. Wrigley,
Lieut., (jg) U.S.N.R.,
Engineering Instructions

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Herman E. Halland,
Commander, U.S.N.,
Assembly & Repair Officer

U. S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
Assembly and Repair Department

28 January, 1943

LOCAL TECHNICAL ORDER No. 6-43

SUBJECT: Carburetor Air Temperature Gages - Installation of Navy Type.

Reference:
(a) NAS Corpus Christi Engineering Instructions #149-42.
(b) NAS Corpus Christi A&R Dept. Dwg. #3K 300.

1. Air Corps type carburetor air temperature gages installed on airplanes assigned to this Station will, when necessary, be replaced by Navy type FSSC 88-I-2880 gages and FSSC 88-B-900 thermometer bulbs. Navy gages shall not be used with Air Corps thermometer bulbs and vice versa except when absolutely necessary, in which case the gage resistance must be modified to conform to specifications.

2. Manufacture and install a "mixture" warning plate in accordance with reference (a). Squadron personnel should note that the gages indicate mixture and not carburetor air temperature.

D. A. Wrigley,
Lieutenant, U.S.N.R.,
Chief Engineer.

C. E. Ekstrom,
Commander, U.S.N.,
Assembly & Repair Officer.

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U. S. NAVAL AIR STATION CORPUS CHRISTI, TEXAS
ASSEMBLY AND REPAIR DEPARTMENT

MODEL SNV-1 AIRPLANE - LOCAL CHANGE NO. 110

SUBJECT: Model SNV-1 Airplane - Installation of Tachometer and Manifold Pressure Gage.

REFERENCE:
(a) Buaer ltr. Aer-E-3319-NIC, VSNV1/F1-1, #079260 of 17 June, 1942.
(b) NAS Corpus Christi A & E Dep't Dwg. #173, Alt. "A", 3 sheets.
(c) Buaer Circ. ltr. #42-41 of 18 December, 1941

1. Reason for Change: To completely equip the subject model airplanes for instrument flying.

2. Application: This change is mandatory and shall be incorporated by squadron personnel in all model SNV-1 Airplanes.

3. When Change is to be Made: To be accomplished as soon as practicable after receipt of material but not later than the next overhaul. Routine flight operations need not be interrupted pending incorporation of this change.

4. Description of Change:

(a)

(a) Disconnect all instrument lines and electrical conduits from the rear instrument panel, Part No. 74-66004, and remove the panel from the airplane.

(b) Relocate the spare lamp clips, manufacture and install a patch plate over the 2-1/4" dia. spare instrument hole in accordance with sheet 1 of reference (b).

(c) Reinstall the rear instrument panel, with the manifold pressure gage (F.S.S.C. No. 88-G-700) in the lower-center hole, and the cylinder head temperature and engine unit gages each being moved one hold to the left.

(d) Remove the present tachometer generator and replace with a Mk V generator, screw mounting (F.S.S.C. No. 88-B-1375). Manufacture and install support bracket in accordance with sheet 3 of reference (b).

(e) Remove the firewall junction box, part No. 74-78144, and enlarge the conduit outlets from 9/16" to 5/8" dia. in accordance with Detail A of reference (b), sheet 2.

(f) Install Mk V tachometer indicators (F.S.S.C. No. 88-I-2500) on front and rear instrument panels and connect conduit.

5. Weight and Balance: The effect of this change on the weight and balance of the airplane is negligible.

6. Source and Distribution of Necessary Parts: The necessary material for accomplishing this change may be obtained from stock. Instruments will be drawn from Supply.

7. Disposition of Obsolete Material: Removed Air Corps Instruments will be returned to Supply for disposition as directed by reference (c).

D. A. Wrigley,
Lieutenant, U.S.N.R.,
Engineering Superintendent.

Walter H. Lees,
Lt. Commander., U.S.N.R.,
Assembly & Repair Officer

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15 July, 1941

A & E Dept. Manual XII-1 _____ Rec. Instr. #48 _____

U. S. NAVAL AIR STATION CORPUS CHRISTI, TEXAS
ASSEMBLY AND REPAIR DEPARTMENT

SNJ-3 LOCAL CHANGE #102

SUBJECT: Model SNJ-3 - Airspeed Indicators - Change in Calibration.

REFERENCE:

(a) The Commander Training Squadron Thirteen Ltr: VN13D8/F31-S; WIR/law of 19 June, 1941 - First Endorsement: The Superintendent of Aviation Training: F31: T/HFF/JJ of 23 June 1941.

1. Basic letter of reference (a) requests recalibration of subject airspeed indicators from miles per hour to knots. Equipment is at present being manufactured to accomplish this re-calibration in the Instrument Shop.

2. As soon as the Instrument Shop has the necessary equipment, inform the Planning Division who will arrange between operations and Instrument Shop for the requested recalibration of subject instruments.

J. C. Sandorf,
Aero Engineer.

Approved:

D. A. Wrigley,
Ens., DE-V(G), U.S.N.R.,
Engineering Superintendent.

Herman E. Halland,
Lt. Comdr., USN.,
Assembly & Repair Officer

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U.S. NAVAL AIR STATION CORPUS CHRISTI, TEXAS
ASSEMBLY AND REPAIR DEPARTMENT

ENGINEERING INSTRUCTIONS - NO.48
Amendment No. 1

SUBJECT: Model SNJ-3 Airspeed Indicators - Change in Calibration.

REFERENCES:
(a) NAS Corpus Christi Engineering Instructions No. 48.

1. Reference (a) directs the recalibration of airspeed indicators from miles per hour to knots. As this cannot be done simultaneously on all indicators of each squadron, the two scales may confuse student fliers.

2. Therefore airspeed on and for airplanes of Squadron 12 shall not be recalibrated for the present.

J. C. Sandorf,
Aero. Engineer.

Approved: D. A. Wrigley,
Mns., DE-V(G), U.S.N.R.,
Engineering Superintendent

Herman E. Halland,
Lt. Comdr., U.S.N.,
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Aer-E-3312-NIC
VSNJ3/F31
F31
053466

NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

5/2/42

From: Chief of the Bureau of Aeronautics.
To: All Stations, Ships and Units concerned with Model SNJ-3 Airplanes.

SUBJ: Model SNJ-3 Airplanes - Bulletin No. 9 Instruments - Air Corps Type, replacement of.

Refs: (a) BuAer. Circular ltr. 42-41 dated 18 December, 1941.
(b) Naval Air Station, San Diego, ltr. VSNJ/F31 (704274) (246-DN) dated 14 April, 1942.
(c) Naval Air Station, San Diego, Local Change No. 101 dated 29 March, 1942
(d) Naval Air Station, San Diego, Dwg. No. 5-3055.
(e) Naval Air Station, San Diego Dwg. No. 5-3047.
(f) Naval Air Station, San Diego, Dwg. No. 4-3122.

1. The bureau has been advised that in complying with the instructions in reference (a), regarding the replacement of Army instruments with Navy instruments, it was found necessary to modify the front and rear instrument boards in the Model SNJ-3 airplanes. The changes required are shown on references (d), (e) and (f). References (d) and (e) show changes in the instrument panel cut-out. Reference (f) shows a mounting bracket for the Mark 8 compass in the rear cockpit.

2. Copies of references (d), (e) and (f) are available in the Bureau of Aeronautics and the Naval Air Stations, Norfolk and San Diego, will be furnished upon request.

J. H. OSTRANDER, Jr.
Capt., USN,
By direction Chief of Bureau.

EXHIBIT I

NAVY DEPARTMENT
BUREAU OF AERONAUTICS
WASHINGTON

18 August 1943

MEMORANDUM FOR MR. DONALD C. COOK, ROOM 1036:

Subject: Naval Air Station, Corpus Christi, Instrument Overhaul Shop Comments (undated).

Reference: (a) Subject comments.

1. The subject comments are in the main intelligent and constructive. There are some minor inaccuracies due apparently to inadequate information being received at Corpus Christi. Constructive action to improve this situation has been taken as follows:

(a) Action was initiated on 23 July to cancel Buaer Circular Letter 43-41 and the SOA Circular Letter on which it was based. Oral approval has been received from the Army Air Forces. This circular letter in essence provided that the Navy would not overhaul Army's instruments and vice versa and that each service would use its own instruments as replacements if there was an acceptable substitute. An acceptable substitute was defined as one which required only modifications to the cut-outs on the instrument panels and replacement of fittings if they were not of the AN type. This circular letter which was suggested by overhaul bases was an economical procedure at its inception. Now, however, the quantity of Army-procured planes operated by the Navy and vice versa has become so large that it's retention is considered undesirable.

(b) Always, spare Army instruments have been procured where there was no acceptable substitute. Procurement is now being initiated

MEMORANDUM FOR MR. RONALD C. COOK, ROOM 1026:

Subject: Naval Air Station, Corpus Christi, Instrument Overhaul Shop Comments (undated).

- -

of an increasing quantity of Army instruments, even though Navy replacements, which require little alteration to the instrument board, are available.

(c) Similarly, spare parts for these Army replacement instruments are being procured.

(d) Personnel from the Instruments Branch and the Maintenance Division recently visited the East Coast overhaul bases and as far west as Pensacola. Trips like these are most productive inasmuch as the oral exchange of ideas clears up misunderstandings much better than by written communications. A similar trip to the remaining overhaul bases within the continental limits of the United States, including Corpus Christi, is planned for September. If such a trip had been made to Corpus Christi, it is probable that 90% of the criticism contained in the subject memorandum would have been eliminated.

(e) The production of aircraft instruments is excellent. In fact, we have been holding down production now for 17 months. The distribution of replacement instruments is poor. Instruments for new construction aircraft are shipped directly from the instrument manufacturer to the airplane manufacturer. East of the Mississippi they are shipped 90 days prior to the time the airplane flies; west of the Mississippi they are shipped 150 days prior to the time the airplane flies. In the past the replacement or spare instruments were shipped from the instrument

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manufacturer to 3 main supply points, namely, the Aviation Supply Annex, Oakland, California; the Aviation Supply Annex, Norfolk, Virginia; and the Naval Aircraft Factory, Philadelphia, Pennsylvania (now to the Naval Aviation Supply Depot, North Philadelphia, Pennsylvania). There they remain in stock awaiting requisition by the other 17 major supply points. Generally speaking, the Supply Officers, due to lack of stowage and personnel, have not requisitioned as many instruments as we have believed they needed. We have started now to ship instruments without waiting for requisitions from the major supply points. This shortens the transportation time and should result in a better distribution of spare instruments. It also eliminates a considerable amount of paper work.

2. It is undesirable to maintain spare instruments for the life of an airplane that are 100% identical with the instrument initially installed. There must be progress. Better instruments come into production each year; standardization of instruments is constantly being accomplished; production lines of instruments which are essentially similar are being combined into fewer lines. On the other hand, it is unwise to furnish always nothing but the best and latest instruments as a replacement. Sometimes the man-hours required for the change would be ridiculously excessive. A medium must be drawn between these two extremes and that is what we, in conjunction with the Army Air Forces and the War Production Board, attempt to do. In so doing, we will always step on someone's conception of how it should be done.

3. If the services and the airplane contractors and instrument manufacturers never coordinated, we would

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have many times as many instruments in use and in production as we do have under our coordination. This obviously would result in a huge distributing and stocking problem and an inefficient production system. Standardization is achieved in several ways. There is an Army-Navy-British Instrument Standardization Committee which is constantly reducing the number of models of instruments produced and used. Again when each service meets with an airplane contractor to decide the instruments that will go in a specific model airplane, standard AN instruments are used if at all possible. In addition there is an Army-Navy-War Production Board Committee which periodically visits instrument manufacturers and forbids their manufacturing instruments other than certain standard models. In one specific case the number of altimeters an instrument manufacturer had in production was reduced from 55 to 1. The total number of instruments that this manufacturer was authorized to build was reduced from over 400 to approximately 20.

4. As this standardization is achieved, however, there will necessarily result the necessity of substitution of instruments for those initially installed. Even at Corpus Christi at sometime in the future it will be impossible to furnish Army replacement instruments inasmuch as some of those lines will have been discontinued. This policy will reduce the distributing and stocking problem all over the world. It will reduce the number of different types that have to be overhauled but it will result in some complaints where certain holes on the instrument board may have to be replaced or wiring changed or special brackets manufactured. Again I say it is a compromise to save man-hours all over the world even though it may result in increased man-hours occasionally under certain conditions at certain places. It is certain, however, that the basic policy is correct and does further the war effort.

5. Referring specifically to changing Army miles-per-hour airspeed indicators to Navy and back again

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to Army as described on pages 3 and 4 of the subject memorandum, the primary blame in this case it seems would attach itself to the Naval Air Station, Corpus Christi. To begin with there was a huge stock of spare Navy type airspeed indicators at Corpus Christi or at the named stocking points. The low-speed Army airplanes use the 0 to 160 knot Navy type Federal Standard Stock Catalog No. 88-I-340. The high-speed Army airplanes use the 0 to 430 knot type FSSC No. 88-I-350. Stocks of each in good condition ready for issue at Corpus Christi and the total available at the major stocking points are shown in the following table as of the dates indicated:

Airspeed Indicator Stocks

	88-I-350		88-I-340	
	Total	Corpus Christi	Total	Corpus Christi
31 January 1943	7301	125	5606	244
28 February 1943	8397	61	7702	565
31 March 1943	6504	33	7518	570

It is very difficult to modify the mechanism of an airspeed indicator calibrated in knots so as to calibrate it in miles-per-hour or vice versa. I am amazed that any major overhaul station should attempt this; however, with such lack of knowledge it is to be expected during wartime. We did procure replacement Navy knot dials for Army airspeed indicators and instructed all Naval Reserve Aviation Bases to obtain them from the Naval Aircraft Factory, Philadelphia. Apparently this letter was not available at the overhaul office at Corpus Christi. Nevertheless, there were Navy replacement instruments at the station and more could have been obtained at a moment's notice as the production rate of airspeed indicators, like practically all instruments, has been held down.

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6. In the subject memorandum there are some details which might be touched upon briefly:

(a) On page 3 complaint is made that the Navy uses only one thermometer whereas the Army uses several. The Navy single model then requires a nameplate placed on the instrument board itself whereas the Army's model carries the nameplate as part of the instrument. At one time the Army's idea was being standardized and it would have resulted in stocking 14 different models of thermometers, the only differences being in what function they performed. The Navy's policy of using a single thermometer and placing the nameplate on the instrument board was accepted and it is obvious that a terrific stocking problem was overcome and that it is easier to manufacture a decalcomania nameplate than to manufacture a complete high precision instrument.

(b) The pitot static tube for the SNB-1 airplane discussed on page 6 does have a Navy replacement which is identical with the Army type. The Navy designation is 88-3-3310 and the Army type is B-3. These have been procured and are in stock. The pitot static type is in the process of being standardized as an AN instrument.

(c) Also on page 6 it is noted that they are using apparently the Navy Mark 4 drift sight as their spare for the Army's B-3. It was never intended that this should be done and in fact, of the 136 procured in 1938, I had no idea that any of the Mark 4 Navy type were available for replacement purposes. We have procured the Army type as replacements and some are in stock.

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(d) Also on page 6 replacements for Army's fuel air ratio indicators are not and will not be procured, as this bureau does not approve of their use.

(e) Also on page 6 there is reference to installing two single Navy engine cylinder thermometer indicators for a dual Army type. This was unnecessary as there is a Navy dual type in existence and available. While there were none in stock at Corpus Christi for unknown reasons, they were available throughout the country--1066 on 31 January 1943, 924 on 28 February 1943, and 482 on 31 March 1943.

(f) The lack of replacement Navy instruments at Corpus Christi stated on page 7 is due to poor distribution. The instruments were in Navy stock in excessive quantities.

(g) With reference to the statements on page 10 that Army instruments are better constructed and more precise than Navy instruments it is believed that these statements are based on opinions formed from a few isolated cases, for the following reasons. The fact that many Army and Navy instruments made under peacetime and early war designs were not interchangeable would lead one to believe that the mechanisms and workmanship were likely to be quite different. Actually this is not the case, as the differences responsible for non-interchangeability were largely such items as dials, fittings, and external dimensions. Since the basic design and the manufacturers were in most cases the same for the Army and for the Navy, it is difficult to believe that there would be material differences in workmanship and precision. Instruments currently being produced are mostly Army-Navy standard types and are

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identical in all respects, being produced on the same production lines.

7. Please let me know if there is anything further that I can add in clarification of this situation at Corpus Christi and of the remedial action that has been taken.

Respectfully,

CLYDE W. SMITH
Commander, USN

CWS:ids