BM2-1-64
19.9.55
SECRET

Mr. J. Lukasiewicz
Mr. O.E. Michaelsen

A meeting was held in Room 113 of Bldg. M-2 on Friday, September 16, to discuss procedure to be used in carrying out a supersonic fighter configuration study in the Flight Research and Aerodynamics Sections.

It was agreed that the following information should be gathered together and reproduced for the use of those carrying out the work. Those responsible for gathering each item of information are listed.

1. Avro estimates of PS-13 installed thrust and fuel consumption - Michaelsen.

2. Copies of PS-13 engine and afterburner drawings - Michaelsen.

3. Details of the CF-105 rear end airframe geometry, showing by-pass and ejector shape, with important dimensions - Michaelsen.

4. Pressure recovery and mass flow data for PS-13 engine as installed in CF-105 - Lukasiewicz.

5. CF-105 weight and centre-of-gravity list, especially as it pertains to items of fixed equipment - Michaelsen.

6. "Net fuselage volume". The volume of the CF-105 fuselage with engine space, ducts, and fuel space subtracted - Templin.

7. A breakdown of CF-105 fuselage volume into parts which may be of interest in configuration study, e.g., armament bay, ducts, fuel, etc. - Templin.

8. CF-105 fuselage nose cone angle. This to be obtained directly by Templin from CF-105 drawings, but checked with Avro by Michaelsen to determine any limiting value.

9. Empirical equations for estimating structure weight - Templin to obtain from Michaelsen's notes.

If possible, all of the above is to be reproduced, and distributed by Friday September 23, to those engaged on the study. Possibly two copies of all data should go to Flight Research.

RJT

R.J. Templin.

c.c. Mr. P.J. Pocock
Mr. A.D. Wood

RJT/FM

Mr. J. Lukasiewicz
Mr. O.E. Michaelsen
Mr. K. Orlik-Ruckemann
Mr. P.J. Pocock

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Re: Supersonic Fighter Configuration Study

The purpose of this memorandum is to set down, for record purposes, the results of a discussion held on September 7, at which you were present, to settle some of the issues which arise before starting the above study.

There was some discussion of the purpose of the study. It is virtually certain that the CF-105 as presently conceived will fall far short of meeting the required combat performance specification laid down by the RCAF. There is evidence to suggest that, qualitatively at any rate, a different aerodynamic configuration would have given better performance (and also might have eased the stability problem), but at the same time it is realized that the specification is a very difficult one to meet by any known means. Although the NAE may present to the RCAF and DRB a watertight argument that the CF-105 will not meet the specification, there is a noticeable tendency to excuse Avro on the grounds that they have done the best that could be done. It would be an expensive tragedy if the aircraft were finally approved on these grounds, especially if they are incorrect. Only a reasonably detailed study can show quantitatively how much is to be gained by a change in configuration.

Since this type of study certainly does not constitute aircraft design, there are certain factors within the designer's province which it was felt should not be tampered with in the study. It was agreed that all items of equipment should be assumed to have the same weight and volume requirements as in the CF-105, i.e., that the fuselage volume apart from that occupied by fuel would be left unchanged.

If a configuration is proposed having outboard nacelles separate from the fuselage, the volume of the fuselage would, of course, be reduced accordingly.

Standardized empirical methods are to be used for calculating the weight of structure and undercarriage.

The weight of the power control system is to be taken to be proportional to maximum control hinge moments, using Avro CF-105 values as reference.

The installed weight, thrust, and fuel consumption of the Orenda PS-13 engine is to be assumed in the analysis, and the values are to be as calculated by Avro Aircraft for the CF-105 installation.

The drag of the CF-105 and any alternative configurations is to be calculated by the best available methods. Although "collapsed" empirical data may be used as part of the analysis in arriving at a near-optimum configuration, the drag should finally be estimated in detail.

In the interests of simplicity and time, it was agreed that although attention was to be paid to all items in the performance specification, certain items are not to be investigated extensively in arriving at a new configuration. Little attention was to be given to the subsonic combat mission or ferry mission; take-off and landing performance is to be calculated but not allowed to heavily influence the configuration. In addition, dynamic stability characteristics are not to be investigated initially, but may be calculated after freezing a configuration.

The remainder of the discussion concerned personnel who would carry out the work. One of those who obviously ought to be involved is Michaelsen. However, he is heavily laden with work still to be done in connection with his tour of liaison duty at Avro. Some of this work overlaps with the requirements of the configuration study, and it was decided that Michaelsen's previous commitments would not unduly suffer if he were to carry out only the following work in connection with the study. He is to provide other members of the study group with his set of empirical weight estimation formulae, while at the same time checking them against known weight items in the CF-105. He will also provide all the necessary information on the weight and volume requirements of the CF-105 fixed equipment and armament. He will obtain from Avro as soon as possible the Avro Aircraft Company estimates of installed thrust and fuel consumption of the PS-13 engine. He will revise and bring up to date his estimates of the CF-105 drag, and finally, will estimate its performance, using Avro estimates for the PS-13 engine. Practically all of this work he must do in any case in order to write a report on his liaison tour at Avro.

This relieves Michaelsen of any part of the study of alternative configurations. He has, however, been carrying out a preliminary analysis which would eventually have led to the choice of a near-optimum wing configuration, which looks now as if it would be a nearly unswept, tapered wing of aspect ratio around 2.5. This analysis he will describe to the other members of the group so that they can adopt his approach in carrying on with the study.

The configuration study itself is not easily breakable into separate parts and so at this stage it was decided not to attempt this.

The section head is to take charge of the investigation and will try to spend as much time on it as possible.

R. J. Templin.

RJT/FM