SUMMARY

The EB-29B, AAF Serial No. 44-84111, used as the parent airplane for initial flight testing of the XF-85 parasite airplane was modified by McDonnell Aircraft Corporation located at St. Louis, Missouri. It was found that the aft bomb bay provided the most suitable location for the trapeze mechanism and stowage of the parasite fighter. The location, also, placed the XF-85 farthest away from the propeller arcs of the EB-29B, and provided a satisfactory CG travel for the mother airplane when the trapeze and parasite were in the extended position. Structural modifications to the EB-29B consisted mainly of providing structural ties for the trapeze, together with necessary controls for its operation. Additional changes in the communication system, oxygen system, pressurization system and other minor items were made in order to provide crew comfort and facilitate flight testing.

Flight characteristics and engine operation of the EB-29B were found to be quite satisfactory when the trapeze was operated and flown in the extended position. The trapeze imposes approximately a 40 mph decrease in IAS of the EB-29B when operating at normal rated power in level flight, however, engine cooling was easily controlled throughout the operation.

In general, the EB-29B, as modified, has proved itself quite suitable for the flight testing of the XF-85 airplane.

DISCUSSION

A. Modification to the Airplane

1. Rear Bomb Bay.

The rear bomb bay of the B-29 was modified as required for trapeze installation and adequate stowage of the parasite fighter. Reference MAC drawings 12-04201 and 12-04251. The major modifications consisted of:

a. Removal of rear bomb bay doors (Fig A-1).

b. Removal of tunnel in rear bomb bay.

c. Removal of bomb racks (Fig A-1).

d. Installation of nose fairing on forward section of rear bomb bay to prevent engine windmilling of the XF-85 when stowed in flight (Fig A-2).

e. Extension of rear bomb bay forward by removing radar equipment under wing root and removing approximately 30 inches of skin (Fig A-2).

f. Addition of protector plates for B-29 fuel transfer line (Fig A-2).

g. Installation of CO_2 fire extinguisher system under wing root to be expended in the XF-85 inlet duct if required (Fig A-2).

h. Installation of oxygen outlets and communication outlets in rear bomb bay.

2. Front Bomb Bay

The front bomb bay [illegible]

trapeze reservoir and emergency hydraulic pump. A bomb bay floor was installed for the accessibility of these units in flight.

3. Tail Skid

The normal tail skid of the B-29 was modified to protect the XF-85 belly skid and ventral fin when landing.

This modification consisted of doubling the length of the normal tail skid and utilizing the normal actuator for operation. The only great change to the B-29 configuration was that in the retracted position of the new skid remains in a position similar to a normal skid, fully extended. A tail fairing was added to minimize this additional drag. (Fig A-3 and A-4) (Reference MAC drawing 12-04201) The tail skid is actuated through an individual switch located on the pilot's aisle stand.

4. Aft Pressurized Compartment

This compartment of the airplane has been utilized as the control station for the trapeze extension and retraction.

The modifications required were:

a. Installation of a trapeze control panel (Fig A-5).

b. Installation of a bench for the XF-85 pilot and XF-85 mechanic to ride while in the B-29 (Fig A-6).

c. Installation of required oxygen and communication stations for those extra persons (Fig A-6).

5. Communications

It was found that the complexity of this launching and retrieving operation required the XF-85 pilot, the trapeze operator and the B-29 pilot to be in radio contact with each other at all times. These three men remain on VHF throughout the operation while the scanners, co-pilot and flight engineer remained on inter-phone.

It was also necessary to install an antenna beneath the airplane for VFH transmission and reception during the launching and retrieving operation. The change from top antenna to belly antenna was made in the rear pressurized compartment just prior to the primary trapeze operation. After the final retraction of the trapeze the switch was made to top antenna for the continued flight, or let down of the B-29.

6. Camera

The B-29 was equipped for this test program so that camera histories could be made of each drop and return of the XF-85. This required two 16 mm gun cameras. One was installed just forward of the front bomb bay doors on the lowest point of the mold line of the B-29. This camera points aft and down at the trapeze candy-stick (Fig A-7).

The second camera was installed on the under side of the left wing just forward of the left aileron. This camera points down and aft to the trapeze candy-stick (Fig A-8).

B. Operating Technique and Procedure

1. Weight and Balance

Refer to CG diagram Fig B-1

2. Speed-Power Polar

In order to establish the operating characteristics of the B-29, with trapeze equipment, the speed-power polars were flown for various configurations of the modified B-29. These configurations were:

a. Trapeze stowed with and without the XF-85.

b. Trapeze extended with and without the XF-85.

These tests were conducted at 20,000 feet pressure altitude, and at power settings that would determine whether the B-29 could be operated at or below normal rated power for XF-85 tests required.

It was found that with trapeze stowed, with and without the XF-85, the B-29 could be operated normally with some speed loss as shown in Fig B-2 due to the additional drag of the open rear bomb bay and the items of modification that extended outside the mold line of the B-29.

With the trapeze extended without the XF-85, it was necessary to maintain 2400 RPM and vary the manifold pressure as required to achieve various indicated airspeeds. The loss in airspeed due to trapeze is shown in Fig B-2. With the trapeze extended and the XF-85 aboard, there was little noticeable

difference in power required.

From these polars, it was concluded that there was sufficient available power for hook-on procedure at 200 mph IAS at 20,000 feet without operating beyond normal rated power.

8. Flight Handling Characteristics

Taxiing with the XF-85 stowed, with a ground clearance of approximately two inches, presented no problem. Take off and climb at normal rated power to altitude is comparable to a standard combat B-29. Climbing airspeed was 200 mph IAS at 43½ inches Hg and 2,400 RPM. Test altitudes were usually at 20,000 feet PA where stable air was usually found to be smooth enough for this operation.

In order for the XF-85 pilot to gain entry to his airplane, it was first necessary to partially lower the parasite airplane so that the pilot could enter the rear bomb bay. (Note: During lowering and retracting the trapeze it was found that 185 mph IAS should not be exceeded in order that the trapeze would go in and out of the up locks with positive mechanical action.) After the XF-85 pilot enters the rear bomb bay the parasite is again raised into the up position and the pilot enters the airplane in preparation for flight. Upon signal from the XF-85 pilot, the trapeze is lowered to the extended position. During the lowering of the trapeze, with or without the XF-85 attached,

the aerodynamic characteristics are somewhat identical to that noted when 25° of flaps on the B-29 are lowered. That is, a slight amount of nose down trim is required, however, power required to maintain IAS is considerably greater.

At no time during lowering or raising of the trapeze is any buffet discernible. When the trapeze is fully extended the B-29's cruising speed is increased to approximately 200 mph IAS which requires power slightly in excess of the maximum continuous cruising rating for R-3350 engines.

Communication with the XF-85 pilot, B-29 pilot, and the trapeze operator is accomplished by means of VHF radio. After the XF-85 pilot completes his check list and has his engine started, upon signaling the trapeze operator, the nose stabilizer is raised to the up position. From this point on the B-29 maintains level flight at 200 mph IAS and the XF-85 pilot, upon signaling, drops at will. Upon release of the XF-85, a very slight nose-down attitude of the B-29 is noted, requiring slight up elevator trim. Only a slight reduction in manifold pressure (approximately 1½"Hg) is required to maintain 200 mph IAS with the trapeze lowered and the XF-85 away.

During test operations at Muroc on all free flights, the trapeze was kept in the lowered position at all times, however, on all XF-85 flights of longer duration the trapeze should be retracted

and B-29 power reduced to an economical cruise condition maintaining 200 mph IAS.

As shown in Figure 1, the wing tips and tail of the EB-29B were painted permanently with yellow and black to help the pilot of the parasite maintain visual contact with the parent airplane. In the initial phases of the program, the EB-29B carried an M-18 smoke bomb which proved to be ineffective. Since most of the free-flight testing involved practice hook-ons and other testing performed near the parent airplane, its location was generally apparent to the pilot of the parasite. However, on the last flight (523-1) of the XF-85 program, the parasite was separated from the parent airplane for a short time and the pilot experienced considerable difficulty finding the parent airplane. Because of the limited fuel supply available in the parasite, it is definitely recommended that a more positive means be provided for maintaining contact between the parasite and the mother airplane during future flight testing of this type.

Upon signal that the XF-85 is to be returned to the parent airplane, the trapeze can be rapidly lowered in a matter of several minutes for the retrieving operation. Successful retrieving of the XF-85 was accomplished at 200 mph IAS in level flight. The only coordination found necessary for the retrieving operation was for the B-29 pilot to be advised as to the XF-85's relative

position in order that the B-29 could be flown as accurately as possible during this small interval of time. Upon a successful hook-on, pitching of the XF-85 damped in about 1 to 1½ oscillations after which the nose stabilizer could be lowered upon a signal from the XF-85 pilot.

After shut down of the XF-85 engine and a cooling period of several minutes, the XF-85 is retracted to the up position. The procedure for the XF-85 pilot leaving the airplane is identical to the entering procedure, as previously outlined, except in reverse order.

It is interesting to note that when the XF-85 is maneuvering in captive flight it appears to tug at the trapeze bar, however, this has not been objectionable and only small deflections of the trapeze have been noted. There is also a very slight buffeting noted during the raising of the trapeze nose stabilizer, but this rapidly vanishes when the nose stabilizer is in the up position. Landing the B-29 with the XF-85 attached has presented no extraordinary technique, however, it was standard practice to make a shallow approach rounding out to approximately a three point landing. The flap travel of the B-29, both mechanically and aerodynamically is not restricted.

4. Power Procedure and Operating Limits

From a power standpoint, the B-29 was operated according to specified Air Force standards at all times. However, there were certain techniques that were found to be required in order to operate the B-29 within these specified limits.

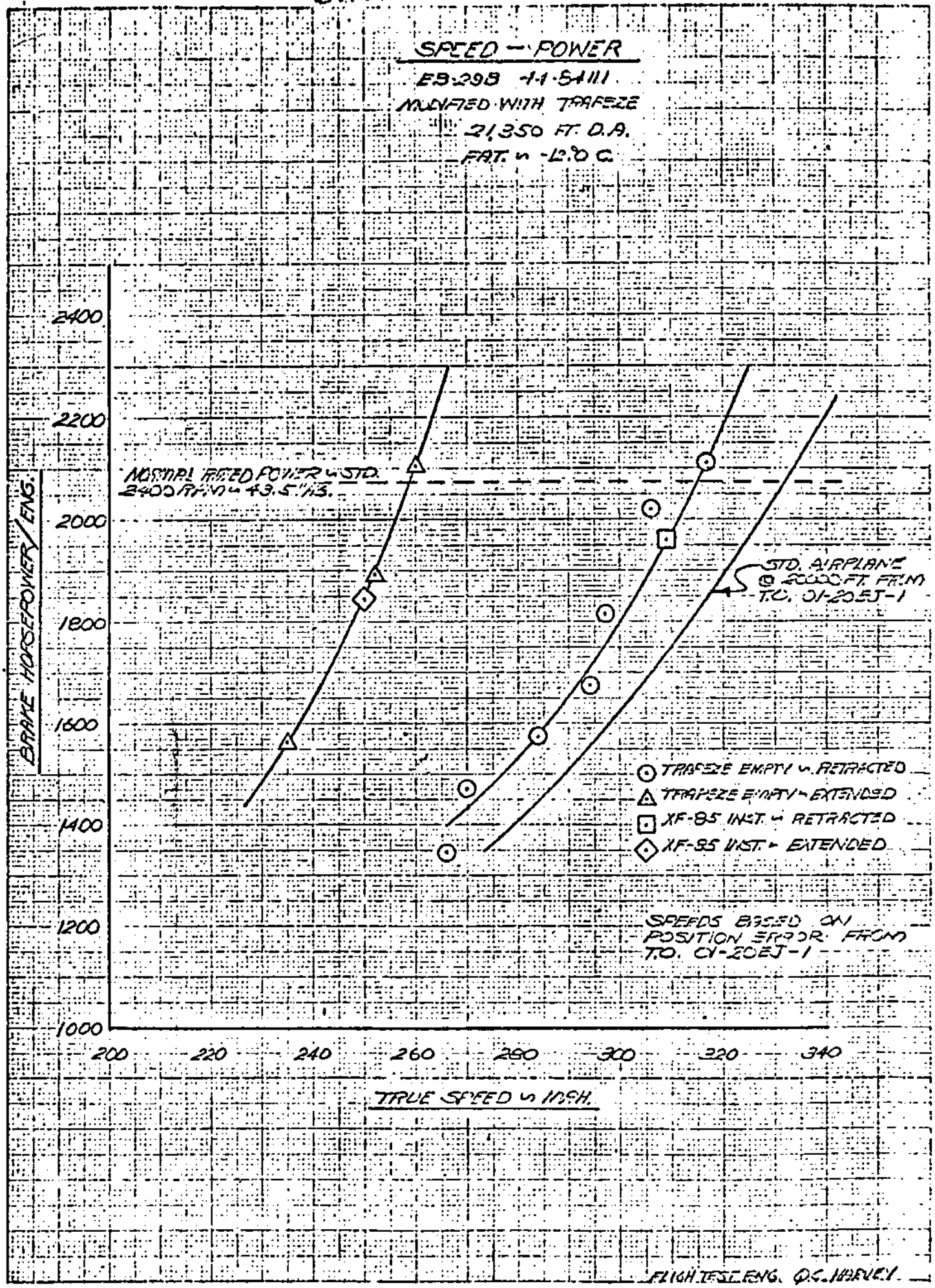
It was found that after the climb to altitude better performance could be realized during the trapeze lowering period if the engines could be allowed a stabilizing period of approximately five minutes under reduced manifold pressure at 2400 RPM. When the engines had properly stabilized, the trapeze lowering procedure could begin and the engines would not overheat or show indications of overloading throughout the increase in power.

Cowl flaps, inter-coolers and oil coolers were controlled manually throughout the operation and procedure was normal for the increase in power.

B-29 Load Condition for Figure B-1

The gross weight includes 400 pounds of ballast in the nose compartment and 1396 pounds of ballast on the forward rack in the forward bomb bay, 4500 gallons of fuel, full oil, three man crew forward, five man crew aft and XF-85 installation.

1.	Condition	1. Gross weight (takeoff) - landing gear down
2.	"	2. Gross weight (takeoff) - landing gear up
3.	"	3. Remove 1,000 gallons
4.	"	4. Move pilot to XF-85 and lower trapeze to aft position.
5.	"	5. Complete extension of trapeze
6.	"	6. Release XF-85
7.	"	7. Retract trapeze
8.	"	8. Remove 300 gallons fuel
9.	"	9. Lower trapeze
10.	"	10. Retrieve XF-85 (100 gallons of fuel expended)
11.	"	11. Retract trapeze to most aft position
12.	"	12. Complete retraction and move pilot
13.	"	13. Let down (expend 200 gallons of fuel)
14.	"	14. Gross weight (landing) - landing gear down


SPEED — POWER
E3-298 -1-1-54111
MODIFIED WITH TRAPEZE
21,350 FT. D.A.
FAT. = -2.0 C.
BRAKE HORSEPOWER/ENG.
2400
2200
2000
1800
1600
1400
1200
1000
NOMINAL RATED POWER = STD.
2400 R.P.M. = 43.5" M.P.
STD. AIRPLANE
@ 20000 FT. FR.M
T.O. 01-20EJ-1
TRAPEZE EMPTY = RETRACTED
TRAPEZE EMPTY = EXTENDED
XF-85 INST. = RETRACTED
XF-85 INST. = EXTENDED
SPEEDS BASED ON
POSITION ERROR FROM
T.O. 01-20EJ-1
200
220
240
260
280
300
320
340
TRUE SPEED = M.P.H.
FLIGHT TEST ENG. Q.C. HARVEY

C. Suitability

The B-29 was found to be adequate in all respects in testing the XF-85 parasite fighter. However, with a more streamlined trapeze the B-29 would be even more adequate because there would be an excess of horsepower available at hook on speeds. This would allow a greater range of hook on velocities and facilitate the testing of the XF-85 parasite fighter.