



INTER-DEPARTMENTAL MEMORANDUM

Ref: 4462/20/J  
Date: December 8, 1958  
To: Mr. F. Brame - Chief of Technical Design  
From: J. Lucas - Chief of Performance Evaluation  
Subject: PRELIMINARY PERFORMANCE ANALYSIS OF FLIGHTS PRIOR TO PHASE 2  
PERFORMANCE TESTING

Attached herewith please find report 71/FAR/32 Extract on Arrow 1, Performance Analysis of Flights Prior to Phase 2 Performance Testing and 71/FAR/48 Extract on Preliminary Supersonic Drag and Subsonic Cruise Results (including ejector comparisons). Pertinent results are presented herewith but all working data are only available in the original reports.

The results of 71/FAR/48 are deemed more reliable than those from 71/FAR/32 (with the exception of the Crash landing Analysis) since the test data was obtained from an automatic observer rather than from flight reports and/or pilot's notes.

Flights analysed are as follows:

71/FAR/32	i)	Flight 7 aircraft 25201,	High Speed run at M = 1.52 at 49,000'
	ii)	" 11 "	" , Level Speed run, M = .89 at 30,000'
	iii)	" " "	" , Crash Landing Analysis
	iv)	" 9 "	25202, High Speed run at M = 1.86 at 50,000'
	v)	" 10 "	" , Buffet Onset at 25,000' and 40,000'
	vi)	" 13 "	25202, Time to Height, Climb
71/FAR/48	i)	Flight 2 aircraft 25203,	Accel. level and climb (cyl. ejector)
	ii)	" 3 "	" " " " (diverg. " )
	iii)	" 4 "	" , Steady level cruise ( " " )
	iv)	" 6 "	" " " " ( " " )

It was found that:

- 71/FAR/32 (a) Aircraft drag at M = 1.52 at 49,000 ft. and at M = .89 at 30,000' appears to be equal to or less than estimations of Periodic Performance Report No. 11.
- (b) Fuel flow instrumentation was inadequate for any reasonable degree of measuring accuracy.
- (c) From a performance point of view, no abnormalities were evident from the crash landing of flight No. 11 on aircraft 25201 other than slightly lower speeds at 50 ft. and at touchdown and an earlier chute opening time. The aircraft left the runway after slowing down to approx. 56 knots.



- (d) The max. speed that can be achieved at 50,000 ft. under standard conditions appears to be  $M = 1.918$  compared to the estimated speed from Performance Report No. 11 of  $M = 1.646$ .
- (e) Buffet onset appears to be lower than estimated at subsonic speeds, but this is largely a matter of definition as to what is a tolerable degree of buffet.
- (f) Min. time to height of 40,000 ft. appears to be greater than estimates and minimum time to height of 50,000 ft. appears to be equal to or less than estimates.

- 71/FAR/48
- (a) With divergent ejector aircraft effective drag is between 10 and 32% lower than estimations from Performance Report No. 11 at altitudes between 36,000 ft. and 50,000 ft. and Mach No's. between 0.77 and 1.73, but higher at 25,000 ft. at Mach numbers 0.77 to 0.92.
  - (b) The subsonic cruise performance is better than estimates at 36,000 ft. but worse than estimated at 25,000 ft.
  - (c) Aircraft effective drag using the divergent ejector is lower (of the order of 9%) than that for the cylindrical ejector at max. power and supersonic speeds. However 1 to 4% of this may be due to a better thrust.
  - (d) The term "effective" drag is used since thrust was not measured directly for solving the drag equation) but only on a  $N_2/\sqrt{\theta}$  basis. Having measured turbine outlet pressure, supersonic thrusts were partially substantiated, but subsonic cruise thrusts may be higher than estimated.

/b

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