TRAINING RECORD
FOR
LETTER OF AUTHORIZATION

AIRCRAFT TYPE: Aero L-39 INITIAL X RECURRENT _____

NAME Michael Akbar Chowdry

ADDRESS _____

CITY Golden STATE CO ZIP 80401

PHONE NUMBER _____

TRAINING

	TRAINER	APPLICANT	DATE
GROUND:			
SYSTEMS	[redacted]	6 Hrs	3-21-98
COCKPIT	[redacted]	2 Hrs.	3-22-98/4-11-98
TAXI	[redacted]	2 Hrs.	3-22-98/4-11-98
EMERGENCY	[redacted]	2 Hrs.	3-22-98/4-11-98
FLIGHT PLANNING	[redacted]	1 Hr.	4-11-98
TOTAL GROUND:	[redacted]	13 Hrs	4-11-98
FLIGHT:			
TRANSITION	[redacted]	1.5 Hrs.	10-12-97
INSTRUMENT	[redacted]	1.5 Hrs.	4-11-98
AEROBATIC	[redacted]	1.5 Hrs.	4-11-98
FORMATION	[redacted]	1.5 Hrs.	4-11-98
SFO	[redacted]	1.5 Hrs.	4-11-98
GO/AROUND	[redacted]	1.5 Hrs.	4-11-98

FLIGHT TIME	DATE	AIRCRAFT #	REMARKS
1.5 Hrs.	10-12-97	N39TZ	Orientation flight - all maneuvers
1.5 Hrs.	3-21-98	N600MC	Initial Training in front seat Kp. +
1.5 Hrs.	3-21-98	N600MC	All maneuvers.
1.5 Hrs.	3-22-98	N600MC	
1.5 Hrs.	4-11-98	N600MC	
1.5 Hrs.	4-11-98	N600MC	
1.5 Hrs.	4-11-98	N600MC	
1.5 Hrs	4-12-98	N600MC	✓ Ride
TOTAL HOURS	12.0		

LIMITATIONS: Formation, Instrument

FAA FORM 8710-1 ATTACHED
MINIMUM HOURS REQUIRED ARE AS FOLLOWS:
GROUND INSTRUCTION------10 HOURS
FLIGHT INSTRUCTION-------5 HOURS

PILOT APPLICANT EXPERIENCE AND PROFICIENCY WILL DETERMINE THE ULTIMATE NUMBER OF HOURS REQUIRED TO COMPLETE TRAINING.

PILOT TRAINING PROGRAM CURRICULUM

AERO VODOCHODY LTD.
CZECH REPUBLIC
L-39 ADVANCED FANJET TRAINER AIRCRAFT

A Pilot/Applicant applying for the issuance of a Letter Of Authorization (LOA) shall meet the minimum requirements for issuance of such LOA in accordance with Federal Aviation Administration (FAA) Order 8130.27, Appendix 3, dated January 11, 1996, including standards of performance setforth in Airline Transport Pilot and Type Rating Practical Test Standards, FAA-S-8081-5 (as amended).

Pilot transition training for the Aero L-39 aircraft will incorporate systems ground instruction and flight instruction utilizing training aids that include, as applicable, the Pilot Ground Training Instructor/Trainee Guide, Pilot Training Syllabus (portions of which may be added, combined or deleted, as appropriate), the Aircraft Flight manual and Pilot Checklists. Instruction will be given/received in the areas of operation and the applicable tasks. The knowledge and flight proficiency demonstration will be conducted in accordance with the standards shown in Airline Transport Pilot and Type Rating Practical Tests Standards, FAA-S-8081-5 (as amended).

SECTION I
Aircraft Systems Ground Instruction

The Pilot/Applicant shall be given/receive ground instruction and shall demonstrate that he/she is adequately knowledgeable of:

1) The aircraft's systems and components.

2) Normal and emergency procedures, including the use of ejection seats if such seats are operational, (abnormal if described in the aircraft's checklist).

3) Use of performance charts including, but not limited to, takeoff, climb, cruise, descent and landing.

4) Fuel requirements and management.

5) Runway requirements and limitations (minimum length and crosswind limits of the aircraft).

6) Contents of the Aircraft Flight Manual or equivalent.

7) Operating limitations prescribed for the particular aircraft, including the adverse effects of exceeding any limitation.

8) Operation of the aircraft in the high altitude regime, if applicable.

Section II
Aircraft Operation/Flight Instruction

The Pilot/Applicant shall be given/receive flight instruction and shall demonstrate that he/she is competent to perform safely the following:

1) Aircraft pre-flight.

2) Cockpit resource management, as appropriate.

3) Powerplant start procedure, taxiing and pre-takeoff checks.

4) Takeoffs and landings (normal and crosswind), as applicable.

5) Aborted takeoffs.

6) Flight at critically slow airspeeds.

7) Approaches to stalls (if appropriate to the aircraft used).

8) Recovery from specific flight characteristics.

9) Normal and emergency procedures (abnormal if described in the aircraft's checklists).

10) Manuevering to landings with simulated powerplant failure, multi-engine aircraft.

11) Zero-flap landings, as appropriate.

12) Rejected landings.

13) Aerobatics-if appropriate to the aircraft and requested by the applicant and if the applicant does not wish to have the limitation, "Aerobatic Manuevers Are Not Authorized" placed on their Letter Of Authorization.

14) IFR-if appropriate to the aircraft and requested by the applicant and if the applicant does not wish to have the limitation, "IFR Flight Is Not Authorized" placed on their Letter Of Authorization.

15) Formation Flight-if appropriate to the aircraft and requested by the applicant and if the applicant does not wish to have the limitation, "Formation Flight Is Not Authorized" placed on their Letter Of Authorization.

Ms. Debra J. Entricken
Federal Aviation Administration
Flight Standards District Office
[redacted]
Oklahoma City, OK 73108

Dear Ms. Entricken,

As holder of an FAA Letter Of Operational Authority for Aero Vodochody L 39C and L-39CT Albatros Aircraft, I submit the following as a result of my evaluation of Mr. Michael Akbar Chowdry, holder of pilot certificate ATP #470-88-7621.

On April 12, 1998 I observed Mr. Chowdry during a pre-flight inspection and in flight, in the L-39C and consider him to have safely performed the following:

1) Aircraft Pre-Flight.
2) Cockpit Resource Management.
3) Powerplant Start Procedures, Taxiing and Pre-Takeoff Checks.
4) Takeoff and Landing (Normal and Crosswind).
5) Aborted Takeoff.
6) Flight at Critically Slow Airspeeds.
7) Approaches to Stalls.
8) Recovery from Specific Flight Characteristics.
9) Normal and Emergency Procedures.
10) Zero Flap Landings.
11) Rejected Landings.

In addition on April 12, 1998, I evaluated Mr. Chowdry in the following areas and found him to be adequately knowledgeable:

1) The Aircraft's Systems and Components.
2) Normal and Emergency Procedures.
3) Use of Performance Charts Including, But Not Limited To, Takeoff, Climb, Cruise, Descent and Landing.
4) Fuel Requirements and Management.
5) Runway Requirements and Management.
6) Contents of the Aircraft Flight Manual and Equivalent Subjects.
7) Operating Limitations Prescribed for the L-39C and L-39CT Aircraft, Including the Adverse Effects of Exceeding Limitations.
8) Operation of the Aircraft in High Altitude Regimes.

Based upon the above satisfactory evaluation, I recommend Mr. Chowdry for a Letter Of Authorization in the L-39C and L-39CT Aircraft, with limitations for **Formation** and **Instrument** flight.

Sincerely,

[redacted]

Thomas W. Kerstine

Michael Akbar Chowdry

Golden, CO 80401

April 12, 1998

Ms. Debra J. Entricken, Manager
Federal Aviation Administration
SW-FSDO-OKC
[redacted]
Oklahoma City, OK 73108

Dear Ms. Entricken,

Please accept this application letter for issuance of a Letter Of Authorization (LOA) for the Aero L-39 Aircraft. This letter and it's attachments are in accordance with Federal Aviation Administration (FAA) Order, 8130.27, Appendix 3.

1) The name of the applicant.
Michael Akbar Chowdry

2) The current address of the applicant and a telephone number where the applicant can be reached during normal business hours.
1952 Montane Drive, East
Golden, CO 80401
Phone: 303-526-5050

3) The grade of the applicant's pilot certificate, pilot certificate number, rating(s) and limitations, along with a description of the pilot's background and hours of experience in the type of aircraft involved or a similar type aircraft.
Airline Transport Pilot, 470887621
Airplane Multiengine Land, CE-500, CL-601, DC-3
Approximately 3000 Hours Total Time
Approximately 2400 Hours Jet Time
Approximately 12 Hours in Subject Aircraft

4) The pilot's plan for transition training to the specific aircraft, including ground, flight and simulator training if applicable. Minimum standards for such training are specified under general training requirements, paragraph 7 of this appendix.
Transition Training for the Aero Vodochody L-39 Aircraft Will Incorporate Systems Ground Instruction and Flight Instruction Utilizing Training Aids That Include, As Applicable, Pilot Ground Training-Trainee Guide, Pilot Training Syllabus, Aircraft Flight Manual and Checklist.
Instruction Will Be Given/Received in the Areas of Operation and the Applicable Tasks and Standards of Performance Required Will Be That Shown in the Airline Transport Pilot and Type Rating Practical Test Standards, FAA-S-8081-5 (as amended).

5) The date and class of FAA airman medical certificate held, including any limitations and whether the pilot applicant has had high altitude physiological training, including the date of such training, as appropriate.

6) The make, model and manufacturer of the aircraft to be flown.
Aero L-39, "Albatros", Aero Vodochody Ltd. Czech Republic.

7) The name of the airport where the aircraft will be based and a description of the proposed flight, or series of flights, including the purpose, airport of departure, airports of intended use enroute and airport of destination, as applicable.
Front Range Airport (FTG), Series of Training Flights to Include, as applicable, Familiarization, Takeoffs and Landing (normal and crosswind), Aborted Takeoffs, Rejected Landings, Flight at Critically Slow Airspeeds, Approach to Stalls (as appropriate), Recovery from Specific Flight Characteristics, Normal and Emergency or Abnormal Procedures, Zero-Flap Landings (as appropriate) and Aerobatics and Instrument Approaches (as appropriate).

8) The portions of the aircraft operating manual that includes the operating limitations for the aircraft and it's current airworthiness status.
See Attachments.

Sincerely,

Michael A. Chowdry

U.S. Department of Transportation
Federal Aviation Administration

Flight Standards District Office
[redacted]
Oklahoma City, OK 73108
Telephone: [redacted]

April 17, 1998

Mr. Michael Akbar Chowdry

Golden, Colorado 80401

Dear Mr. Chowdry:

This letter authorizes you to act as pilot in command in the following experimental aircraft:

Aero L-39 (VFR ONLY)

Flights made under this authorization will be conducted in accordance with the Special Airworthiness Certificate Operating Limitations and all applicable Federal Aviation Regulations (FAR). Formation flight is not authorized.

The privileges of this Letter of Authorization (LOA) may not be exercised unless:

a. Within the preceding six-calendar-months, you have made at least three takeoffs and landings in the above model.

b. After the six-calendar month inactive period, you obtain a flight review including the normal and emergency (and abnormal, if contained in the airplane's checklist) procedures and maneuvers in the particular type airplane and have had your logbook so endorsed by:

(1) The holder of a current and appropriate LOA, who is authorized to make this endorsement and who has found you competent to safely operate the airplane; or,

(2) The holder of a Letter of Operational Authority issued by the FAA.

This authorization expires on April 30, 2000, unless sooner modified, suspended or revoked by this agency.

Sincerely,

[redacted]

Sherrie Carter Brown
Aviation Safety Inspector (Operations)

Michael A. Chowdry

Golden, CO 80401

Ms. Sherrie C. Brown
Federal Aviation Administration
Flight Standards District Office
Oklahoma City, OK 73108

Dear Ms. Brown,

Please accept this letter as my request for the re-issuance of my Letter of Authorization (LOA), to fly the Aero L-39. Enclosed you will find a completed Form 8710-1, correctly filled out and signed.

Thank You in advance for your prompt attention to this request.

Sincerely,

Michael Chowdry

Flight Standards District Office
[redacted]
Oklahoma City, OK 73108
Telephone: [redacted]

CONCURRENCES
ROUTING SYMBOL CMA
INITIALS/SIGNATURE CMA
DATE 7-24-00
ROUTING SYMBOL 02
INITIALS/SIGNATURE SCB
DATE 7/26/00
ROUTING SYMBOL NC
INITIALS/SIGNATURE
DATE
ROUTING SYMBOL
INITIALS/SIGNATURE
DATE
ROUTING SYMBOL
INITIALS/SIGNATURE
DATE
ROUTING SYMBOL
INITIALS/SIGNATURE
DATE
ROUTING SYMBOL
INITIALS/SIGNATURE
DATE
ROUTING SYMBOL
INITIALS/SIGNATURE
DATE

July 24, 2000

Mr. Michael A. Chowdry

Golden, Co. 80401

Dear Mr. Chowdry:

This letter authorizes you to act as pilot in command in the following experimental aircraft:

Aero L-39

Flights made under this authorization will be conducted in accordance with the Special Airworthiness Certificate Operating Limitations and all applicable Title 14 Code of Federal Aviation Regulations (14 CFR). Formation flight is not authorized.

The privileges of this Letter of Authorization (LOA) may not be exercised unless:

a. Within the preceding six-calendar-months, you have made at least three takeoffs and landings in the above model.

b. After the six-calendar-month inactive period, you obtain a flight review including the normal and emergency (and abnormal, if contained in the airplane's checklist) procedures and maneuvers in the particular type airplane and have had your logbook so endorsed by:

(1) The holder of a current and appropriate LOA, who is authorized to make this endorsement and who has found you competent to safely operate the airplane; or,

(2) The holder of a Letter of Operational Authority issued by the FAA.

This authorization expires on July 31, 2002, unless sooner modified, suspended or revoked by this agency.

Sincerely,

Sherrie Carter Brown
Aviation Safety Inspector (Operations)

ASWOKC FSDO:SCBROWN:CMA:7-24-00
H/HOME/REVIEW/LOAMC39

U.S.Department
of Transportation
Federal Aviation Administration

MANUFACTURING INSPECTION DISTRICT OFFICE
FAA BUILDING ROOM 206
WILEY POST AIRPORT
BETHANY, OK 73008

OPERATING LIMITATIONS
EXPERIMENTAL

EXHIBITION - GROUP II AIRCRAFT

MAKE: **Aero Vodochody** MODEL: **L-39CT** SERIAL NO.: **5234** REGISTRATION NO.: **N39TZ**

THESE OPERATING LIMITATIONS ARE A PART OF THE FAA FORM 8130-7 DATED **8/16/96**

PHASE I, INITIAL FLIGHT TEST IN RESTRICTED AREA:

1. No person may operate this aircraft unless the Special Airworthiness Certificate, FAA Form 8130-7, for this aircraft is displayed at the cabin or cockpit entrance so that it is legible to passengers or crew.

2. No person may operate this aircraft for other than the purpose of meeting the requirements of 14 CFR part 91, 91.319(b), as stated in the program letter for this aircraft. Additionally, this aircraft shall be operated in accordance with applicable air traffic and general operating rules of 14 CFR part 91 and all additional limitations herein prescribed under the provision of 14 CFR part 91, 91.319(e). These operating limitations and program letter are a part of the FAA Form 8130-7 and are to be carried in the aircraft at all times for availability to the pilot.

3. This aircraft shall be operated for at least (5) hours with at least (5) takeoffs and landings to a full stop in the geographical area described as follows: All flights will be conducted within a 100 mile radius of Sundance Airpark, Yukon, OK..

4. Application must be made to the geographically responsible Flight Standards District Office (FSDO) for any revision to these operating limitations.

5. The PIC of this aircraft shall notify the air traffic control tower of the experimental nature of this aircraft when operating into or out of airports with operating control towers. The PIC shall plan routing that will avoid densely populated areas and congested airways except when otherwise directed by Air Traffic Control or in an emergency situation.

6. This aircraft is to be operated under VFR, day only.

7. No person may be carried during flight unless that person is essential to the purpose of the flight.

8. No person may operate this aircraft for carrying persons or property for compensation or hire.

9. Aerobatic maneuvers intended to be performed must be satisfactorily accomplished and recorded in the aircraft records during the flight test period.

10. This aircraft shall not be operated unless the replacement times for life-limited parts specified in the applicable technical publications pertaining to the aircraft and its components are complied with. This aircraft, including its related components and systems, must be inspected in accordance with an approved inspection program selected under the provisions of 14 CFR part 91, 91.409(e). This inspection program shall be recorded in the aircraft maintenance records.

11. Inspections shall be recorded in the aircraft maintenance records showing the following or a similarly worded statement: "I certify that this aircraft has been inspected on (insert date) in accordance with the scope and detail of the (identify program title) for (aircraft S/N)" FSDO-approved program dated (date) and found to be in a condition for safe operation." The entry will include the aircraft total time in service (cycles if appropriate); and the name, signature, and certificate type/number of the person performing the inspection.

12. Only FAA-certificated mechanics with appropriate ratings as authorized by 14 CFR part 43, 43.3, may perform inspections required by these limitations.

13. The cognizant FAA FSDO must be notified, and their response received in writing, prior to flying this aircraft after incorporation of a major change as defined by 14 CFR part 21, 21.93.

14. This aircraft must display the word EXPERIMENTAL in accordance with 14 CFR part 45, 45.23(b).

15. This aircraft shall contain the placards, markings, etc., required by 14 CFR part 91, 91.9.

16. The PIC of this aircraft must hold an appropriate category/class rating. If required for the type of aircraft to be flown, the PIC must also hold either an appropriate type rating or a Letter of Authorization issued by an FAA Flight Standards Operations Inspector.

17. The PIC of this aircraft should be knowledgeable of and utilize the procedures described in the Experimental Aircraft Association's "Jet Operations Manual" or other procedures acceptable to the Administrator.

18. The ejection seat system must be placarded as "inoperative" until such time a FSDO approved maintenance program is incorporated and these operating limitations are revised.

19. This aircraft is prohibited from flight with any externally mounted equipment unless the equipment is permanently installed (in a manner that will prevent inflight jettison of the equipment). This permanent installation must be recorded in the aircraft logbook.

20. Following satisfactory completion of the required number of flight hours in the flight test area, the pilot shall certify in the logbook that the aircraft has been shown to comply with 14 CFR part 91, 91.319(b). Compliance with part 91, 91.319(b), shall be recorded in the aircraft logbook with the following or a similarly worded statement: "I certify that the prescribed flight test hours have been completed and the aircraft is controllable throughout its range of speeds and throughout all maneuvers to be executed, has no hazardous operating characteristics or design features, and is safe for operation."

21. The owner/operator of this aircraft must ensure that a copy of the current program letter and any amendments are carried aboard this aircraft at all times.

22. In accordance with 14 CFR part 45, 47.45, The FAA Aircraft Registry must be notified within 30 days for any change of the aircraft registrant's address. Such notification is to be made in the form of a submission of an FAA Form 8050-1, Aircraft Registration Application.

THE FOLLOWING PHASE II OPERATING LIMITATIONS APPLY WHEN OPERATING OUTSIDE THE FLIGHT TEST AREA AFTER COMPLETING THE ENTRY STATED IN LIMITATION NUMBER 20:

1. Limitation 1, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, from Phase I.

2. No person may operate this aircraft for other than the purpose of exhibition, to exhibit the aircraft, or participate in events outlined in **Sundance Airpark Inc. program letter dated 7/6/96** (or any amendments) describing compliance with 14 CFR part 21, 21.193(d). Additionally, this aircraft shall be operated in accordance with applicable air traffic and general operating rules of 14 CFR part 91, and all additional limitations herein prescribed under the provisions of part 91, 91.219(e). These operating limitations and program letter are a part of the FAA Form 8130-7 and are to be carried in the aircraft at all times for available to the pilot.

3. All proficiency/practice flights shall be conducted within the geographical area described in the aircraft program letter and any modifications to that letter, but that area will not exceed 600 nautical miles of the aircraft home base airport. Proficiency flights are limited to a non-stop flight that begins and ends at the home base airport with sufficient fuel reserve to meet the applicable operating rules of 14 CFR part 91. Anytime an alternate airport within the 600 nautical mile radius is selected, the operator must notify their geographically responsible FSDO prior to each proficiency flight away from their home base airport. An exception is permitted for proficiency flying outside of the area stated above for organized formation flying, training, or checkout in conjunction with a specific event listed in the aircraft program letter (or amendments). The program letter should indicate the location and dates for this proficiency flying.

4. This aircraft is restricted to airports that are within airspace classes C, D, E, and G during proficiency flight, except in the case of a declared emergency or when otherwise directed by Air Traffic Control.

5. The owner/operator of this aircraft must submit an annual program letter update to the local FSDO that lists airshows, fly-ins, etc. that will be attended during the next year, commencing at the time this aircraft is released into Phase II operation. This list will be subject to amendments, as required, by letter or facsimile transmission.

6. This aircraft is authorized for flights at air shows or air races conducted under a waiver (if required) issued in accordance with 14 CFR part 91, 91.903.

7. This aircraft must be operated VFR, day only unless equipped for night and/or instrument flight in accordance with 14 CFR part 91, 91.205. Aircraft instruments and equipment installed and used under 14 CFR part 91, 91.205 must be inspected and maintained in accordance with the requirements for those instruments found in 14 CFR parts 43 and 91.

8. No person may be carried in this aircraft during the exhibition of the aircraft's flight capabilities, performance, or unusual characteristics at air shows, motion picture, television, or similar productions, unless essential for the purpose of the flight. Passengers may be carried during flights to and from any event outlined in the program letter or during proficiency flying, limited to the design seating capacity of the aircraft.

9. The PIC of this aircraft shall advise each person carried of the experimental nature of this aircraft.

10. Aerobatic maneuvers that have been recorded during flight test may be performed.

11. This aircraft is prohibited from flight with any externally mounted equipment unless the equipment is permanently mounted in a manner that will prevent inflight jettison, and there is a notation in the aircraft logbook indicating flight testing has been accomplished with this equipment installed.

12. Supersonic flight (true flight Mach number greater than 1) is prohibited unless specifically authorized under 14 CFR 91, 91.817.

13. These operating limitations and airworthiness certificate will bear no expiration date. However, when an aircraft base of operation is changed or there is a transfer of ownership, the new owner/operator will provide the local FSDO with a copy of the approved inspection program identifying the person responsible for scheduling and performing the inspections.

14. This aircraft shall not be used for glider towing, banner towing or intentional parachute jumping.

15. This aircraft does not meet the requirements of the applicable, comprehensive, and detailed airworthiness code as provided by Annex 8 of the International Convention of Civil Aviation (ICAO). The owner/operator of this aircraft must obtain written permission from another country's Civil Airworthiness Authority (CAA) prior to operating this aircraft in or over that country. That written permission must be carried aboard the aircraft together with the U.S. airworthiness certificate and, upon request, be made available to an FAA inspector or the CAA in the country of operation.

16. Flights to maintenance facilities located inside or outside the proficiency area to have maintenance are allowed. For facilities outside the proficiency area stated in the operating limitation number 3 (of Phase II), the owner/ operator must notify and receive permission from the geographically responsible FSDO prior to the flight. The maintenance performed must be recorded in the aircraft records.

KAREN PERKINS
Aviation Safety Inspector (Mfg.)
SW-MIDO-41

8/16/96
Date Issued:

Times for N602MC

Date	Total Time	Pilot/ Flight	Hours M.C.
As of August 14, 1996	11.2	Unknown	
Aircraft surface transported from Czech Republic to Oklahoma City, OK			
As of May 8, 1997	29.7	Unknown	
As of June 10, 1997	32	Unknown	
As of October 10, 1997	37.6	Unknown	
No Date Known	48	Unknown	
As of April 28, 1998	60.5	M.C.	Dual 12
No Date Known		Presume M.C. Time	10
As of September 29, 1998	80.7	Unknown Pilot to Oshkosh and Back	
As of June 28, 1999	90.5	Estimated M.C. Time	10
As of August 1999	100.2	Unknown Pilot to Oshkosh and Back	
As of September 27, 1999	103.7	FTG-ADM-GAD For Annual Unknown Pilot	
As of October 19, 1999	107.4	GAD-TUL-FTG Unknown Pilot	
As of April 28, 2000	111.2	Unaccounted for Presume M.C.	3.8
As of July 15 & 16, 2000	113.5	M.C. Training With Instructor (LOA Renewal)	2.3
As of September 27, 2000	115.5	FTG-OKC for Annual Inspection (Flown by M.C. Instructor)	
As of October 18, 2000	117.6	OKC-FTG Return from Annual (Flown by M.C. Instructor)	
As of November 18, 2000	118.1	Local Flight Atlas Employee Ft. Seat M.C. Back Seat	0.5
		Estimated M.C. Time in N602MC	**38.6**

AIRMAN PROFICIENCY/QUALIFICATION CHECK

08-27-00
LOCATION: IAH

NAME OF AIRMAN (Last, first, middle initial): CHOWDRY, MICHAEL
TYPE OF CHECK: PC -
EMPLOYED BY: PERSONAL BQT.
BASED AT (City and State): DENVER, CO.
TYPE AIRCRAFT/SIMULATOR USED: 737-800
NAME OF CHECK AIRMAN: JIM BUICK
BLOCK TIME: 2+30

FLIGHT MANEUVERS GRADE (S—Satisfactory U—Unsatisfactory)

PILOT S – SATISFACTORY U – UNSATISFACTORY W – WAIVER (See Appendix F to 121)	AIR-CRAFT	SIMU-LATOR
PREFLIGHT		—
1. EQUIPMENT EXAMINATION (Oral or written)		S
2. * PREFLIGHT INSPECTION		S
3. TAXIING		S
4. POWERPLANT CHECKS		S
TAKEOFFS		—
5. NORMAL		S
6. INSTRUMENT		S
7. CROSSWIND		S
8. WITH SIMULATED POWERPLANT FAILURE		S
9. * REJECTED TAKEOFF		S
INSTRUMENT PROCEDURES		—
10. * AREA DEPARTURE		S
11. * HOLDING		S
12. * AREA ARRIVAL		S
13. ILS APPROACHES		S
14. OTHER INSTRUMENT APPROACHES		S
15. CIRCLING APPROACHES		
16. MISSED APPROACHES		S
INFLIGHT MANEUVERS		—
17. * STEEP TURNS		S
18. * APPROACHES TO STALLS		S
19. * SPECIFIC FLIGHT CHARACTERISTICS		S
20. POWERPLANT FAILURE		S
LANDINGS		—
21. NORMAL		S
22. FROM AN ILS		S
23. CROSSWIND		S
24. WITH SIMULATED POWERPLANT(S) FAILURE		S
25. REJECTED LANDING		S
26. FROM CIRCLING APPROACH		S
27. NORMAL AND ABNORMAL PROCEDURES		S
28. EMERGENCY PROCEDURES Boeing		S
29. JUDGEMENT		S
30. HOVERING MANEUVERS		—
31. RAPID DECELERATIONS (Quick stops)		—
32. AUTOROTATIONS (Single engine helo. only)		—

Items that may be waived are indicated by an asterisk (*)
See Appendix F to FAR 121. All applicable items must be graded S, U or W.

FLIGHT ENGINEER ITEM	S	U
1. EQUIPMENT EXAM (Oral) (Written)		
2. PREFLIGHT CHECK OF AIRCRAFT		
3. COMPUTATION OF FUEL LOAD & FUEL LOADING PROCEDURE		
4. COMPLETION OF COMPANY APPROVED FORMS		
5. STARTING, TAXI, AND RUNUP		
6. POWERPLANT AND PROPELLER CONTROL		
7. CRUISE CONTROL AND COMPUTATIONS		
8. AIRCRAFT/POWERPLANT OPERATION ANALYSIS		
9. FUEL SYSTEM MANAGEMENT		
10. AIR CONDITION & PRESSURIZATION CONTROL		
11. ELECTRICAL SYSTEM OPERATION		
12. POWERPLANT FIRE CONTROL		
13. EMERGENCY GEAR AND FLAP EXTENSION		
14. HEATER FIRE AND CARGO COMPARTMENT FIRE		
15. SMOKE EVACUATION		
16. EMERGENCY DEPRESSURIZATION		
17. FUEL DUMPING PROCEDURE		
18. POWERPLANT SHUTDOWN AND RESTART		
19. DEICING AND ANTI-ICING		
20. LOCATION AND USE OF EMERGENCY EQUIPMENT		
21. EMERGENCIES-HYDRAULIC, PRESSURIZATION, ETC.		
22. CREW COORDINATION AND MONITORING		

REMARKS

NICE JOB; P.C. COMPLETE
UPSET MANEUVERS ?
WINDSHEAR COMPLETE.
CIRCLING NOT ACCOMPLISHED

RESULT OF CHECK		CHECK AIRMAN'S PERFORMANCE	
	X APPROVED		SATISFACTORY
	DISAPPROVED		UNSATISFACTORY

REGION	DISTRICT OFFICE	INSPECTOR'S SIGNATURE

FAA Form 8410-1 (4-67) SUPERSEDES FAA FORM 3111 WHICH IS OBSOLETE © FAA AC 23-8734

1.1 INTRODUCTION

Characteristics of the aircraft

The aircraft L-39 ZA/ART is a modification of the jet trainer L-39. It is determined for the training of pilots in the subsonic airspeed envelope. The characteristics of the aircraft enable the elementary training as well as advanced training including aerobatics, flights under bad weather conditions by day and by night and in case of necessity even in combat flights for destroying slow air targets and targets on the ground. The A/C engine is a by-pass air flow jet engine with two shafts of the AI-25 TL type.

1.2 SPECIFICATION

Aircraft:

Span (overall)	9.46 m = 31 ft
Length (overall)	12.13 m = 39.8 ft
Height (overall)	4.77 m = 15.5 ft (when the landing gear shock absorber is not depressed).

Wing:

Geometric shape	trapezoid
Area	18.8 m^2 =202 ft^2
Aspect ratio	5.2
Washout	0°
Sweep-back angle in 25% of profile chord	1°45`
Dihedral	2°30`

Aircraft weights:

Empty	3,466 kg ± 1.5 % = 7,641 lbs ± 1.5 %
Two pilots	160 kg = 353 lbs
Fuel (in fuselage tanks)	824 kg = 1,817 lbs
Standard flight weight	4,450 kg = 9,810 lbs
Maximum ramp weight	5,670 kg = 12,500 lbs

Fuel tanks:

Fuselage tanks total maximum capacity	(290 US gal) = 1,852 lbs
Wing-tip tanks	(53 US gal) = 344 lbs
External drop tanks	(2x93 US gal) = 1,199 lbs

1.3 FLIGHT LIMITATIONS

The using of the aircraft is limited by the following limit modes :

• Maximum ramp weight	12 ,500 lbs
• Maximum landing weight	10,582 lbs

If necessary it is possible to land even with the weight of the aircraft from 10,582 to 12,346 lbs but the vertical speed should not exceed 551 ft/min which corresponds to the vertical load factor $n_y = 2.5$ (according to the datum on the flight recorder FDR).

When the aircraft weight exceed 10,582 lbs, the number of take-offs and landings on grassy runway is limited to 20 % of the total number of take-offs and landings before the overhaul of the landing gear TBO.

1.5 STALLING SPEED

H = 0 ISA, idle run, no ground proximity, tolerance +3 %
The table is valid for flight tests measured at idle run .

Aircraft weight (lb)		9,480 clean aircraft	11, 460 4 rocket launcher	12,345 2×350 l fuel tank 2×500 lb bomb
Flaps deflection	Landing gear	Stalling speed IAS (knot)		
0°	retracted	103	116	120
25°	extended	94	107	111
44°	extended	88	101	105

The stalling speeds for different weights or other atmospheric conditions are possible to calculate by using the formula

$$V_{min} = \sqrt{2mg / C_{Lmax} \cdot \rho . S}$$

where:
- m - aircraft weight
- g - acceleration of gravity
- ρ - air density
- S - wing area
- C_{Lmax} - maximum lift coefficient

The solid lines show the courses of the c_L for three positions of the flaps, the dash lines show the changes (decrease) of maximum c_L values for landing gear extension at the proximity of the ground. See Fig.2.
For each calculation the c_L can be read on the top of the respective curve. For example, for the flying position of the landing flaps (0°) the c_{Lmax} is 1.31.
The Fig.4 shows decrease of the c_{Lmax} with Mach number decrease.
In practice it means that the reserve of the lift coefficient decreases with the Mach number increase and the danger of aircraft stall increases.

Service ceiling

The service ceiling is considered as the altitude where the rate of climb V_y decreases to value V_{ymax} = 100 ft/min.

Aircraft weight (lbs)

9,480	10,900	12,260

Service ceiling (ft)

37,700	28,543	24,606

Up to the altitude 32,810 ft it is considered the maximum rating mode of the engine operation, above 32,810 ft it is considered the rated power only.

The demonstration of rate of climb V_{ymax} and the required climbing time "t" is introduced by the Fig.2.

2.5 CONTROLLABILITY IN UNUSUAL CASES OF FLIGHT

In stall

Transition into stall is fluent with a gentle tendency of rolling to the left or to the right. The rolling is not fast and the aircraft reacts to the counteraction of ailerons. All control devices remain effective.

In spin

The aircraft falls into the spin reluctantly but in the spin considerable changes of angular speeds and longitudinal pitching occur. The left spin is more stable than the right spin, the right one tends to fall into unstable spin.

During take-off

The conditions for the aircraft take-off from the speed v=0 up to the speed for detaching from the ground v_{det} (detaching) are indicated in the figure 13. It shows the dependence among the take-off weight of the aircraft, quality of the runway and length of the take-off run.

3.2 DESCRIPTION OF THE AIRCRAFT

Airframe

The aircraft L-39ZA/ART is of all-metal semi-monocoque structure. From the point of view of the wing-fuselage arrangement it is designed as a low-wing aircraft with a tricycle landing gear (nose L/G and main L/G legs).

The wing and tail surfaces have trapezoidal shape.

The engine is installed in the middle part of the fuselage, behind the cockpit with pilot seats in tandem arrangement. The main fuselage fuel tanks are behind the cockpit

3.2.1 Fuselage

The fuselage is of semi-monocoque structure made from aluminium alloys and heat treated steels.

The streamlined shape of the fuselage is in the middle fuselage part widened by the air intake ducts. The location of the intakes of the air ducts above the wing reduces the possibility to suck in foreign objects to the engine.

For the servicing purposes the fuselage is possible to separate into the two parts, fuselage front part and fuselage aft part. This separation enables to replace the propelling unit as well as to facilitate the access to the engine when it is necessary to carry out some works. The both fuselage parts are connected together at the bulkheads number 37, 38 by five bolts and the axial alignment of the both fuselage parts is secured by two locating pins.

The fuselage front part consists of the following sections:

- fuselage nose section
- pressurized cockpit section
- fuselage middle section

The fuselage nose section extends up to the bulkhead number 7. The leading part of the nose section is the detachable fiberglass cone. The radio equipment is located under the hinged doors in the fuselage nose section.

The pit in the nose section provides a room for the retracted nose landing gear leg.

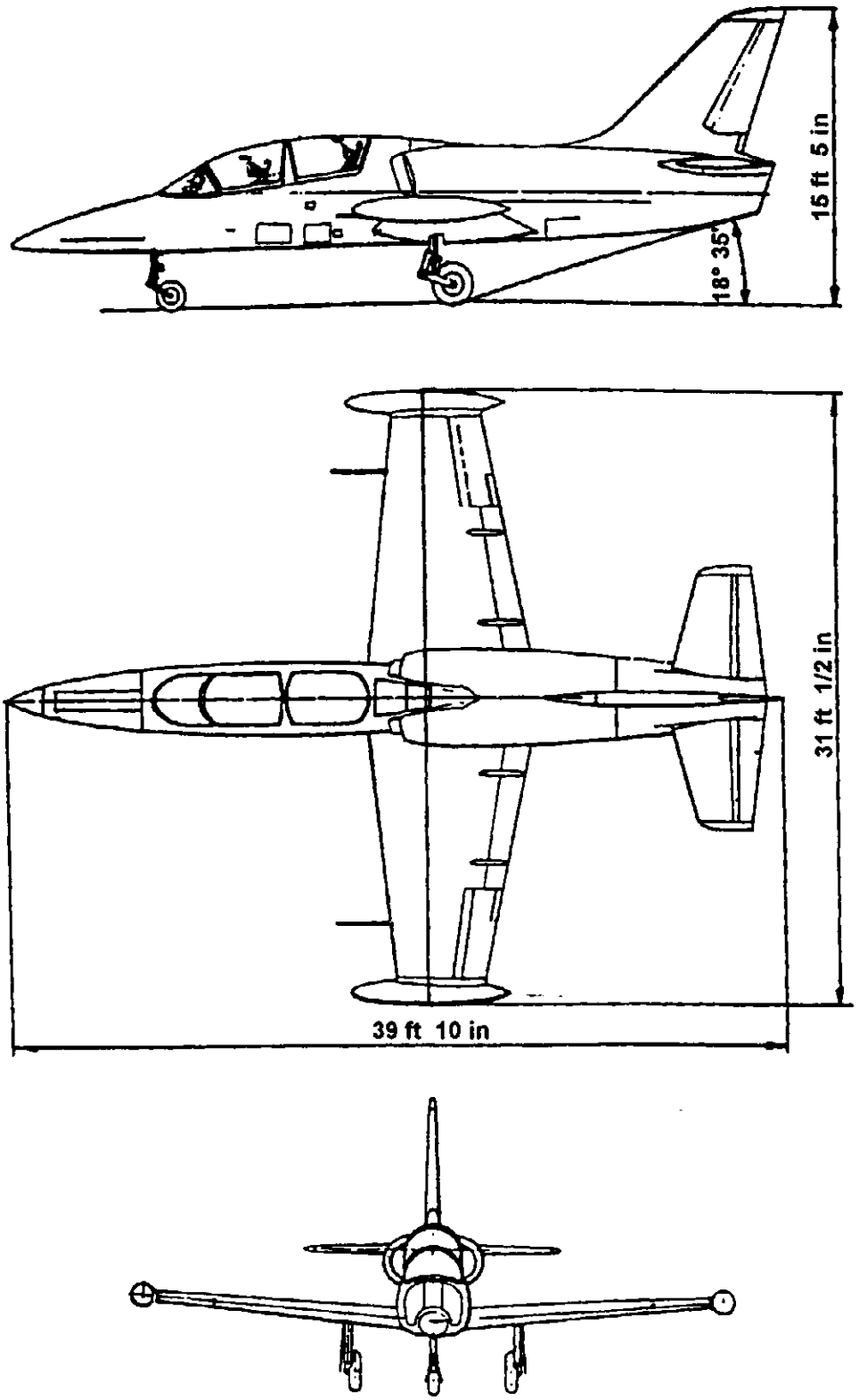


FIG.2. PRINCIPAL DIMENSIONS

3.1 AIRCRAFT CHARACTERISTICS

The aircraft L-39ZA/ART belongs to the family of the aircraft L-39 and it iss the further development of up to now manufactured successful versions of aircraft L-39C, L-39 ZO, L-39 ZA and L-39V.

The aircraft L-39 belongs to the category of jet trainers which is determined for the elementary and advanced training and at the same time it enables the training of the figures of aerobatics. The variant L-39ZA/ART enables to widen the training of pilots as well as the training for combat use and to destroy targets on the ground and slow flying air targets if necessary. The aircraft L-39ZA/ART is a continuation in the development of the version L-39 ZA. The instrumentation of this aircraft makes possible to fly during the day and night even under bad weather conditions. The aircraft L-39ZA/ART is powered with the by-pass jet engine, type AI-25 TL which generates a static thrust about 3,664 lbf at standard conditions. This engine is of two-shaft construction with a three-stage low-pressure compressor (LPC), a nine-stage high pressure compressor (HPC), a one stage high-pressure turbine (HPT) and a two-stage low-pressure turbine(LPT).The electronic outfit for the solution of navigation tasks as well as for the use of weapon delivery and navigation system (WDNS) are supplied by ELBIT.

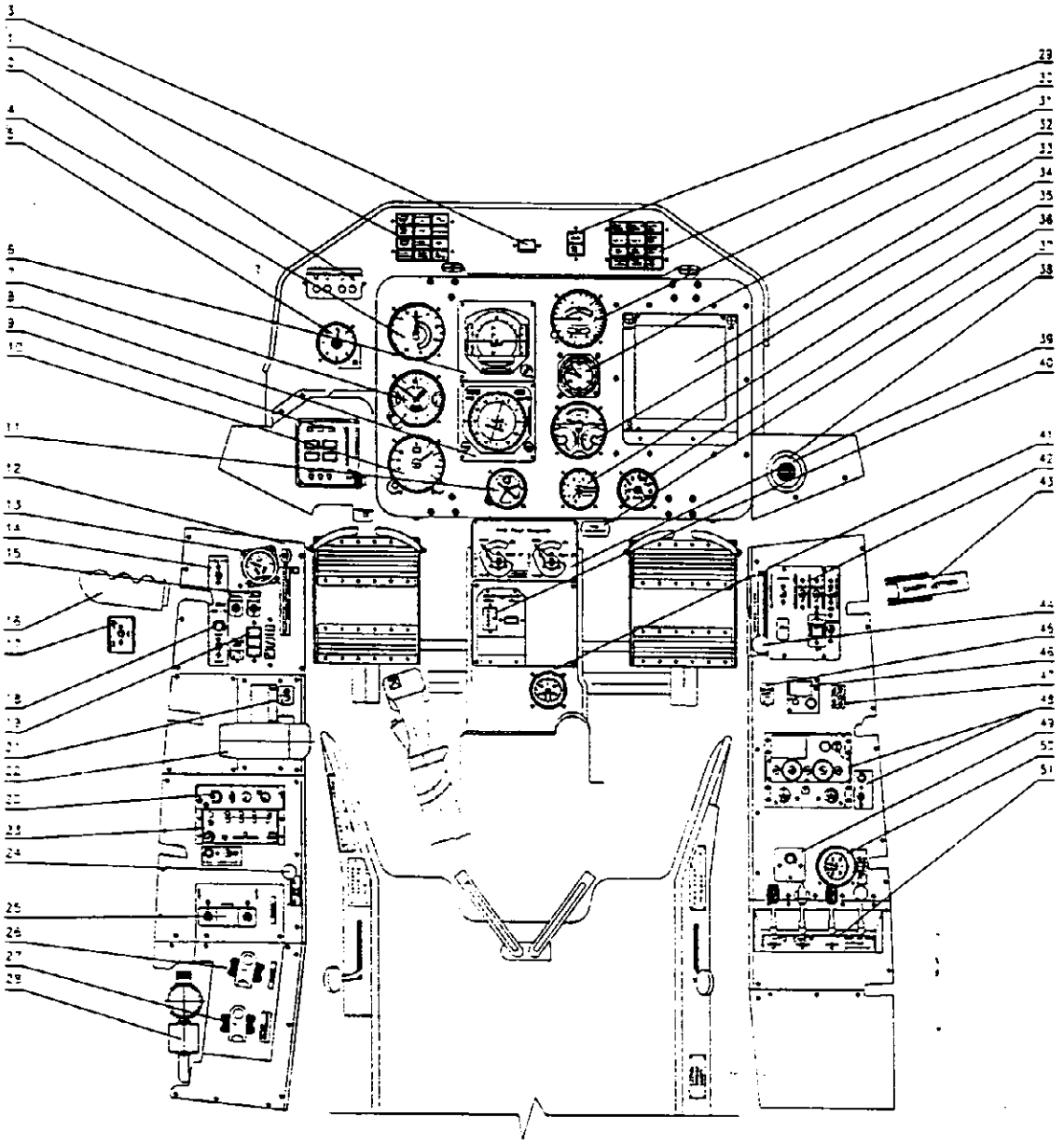
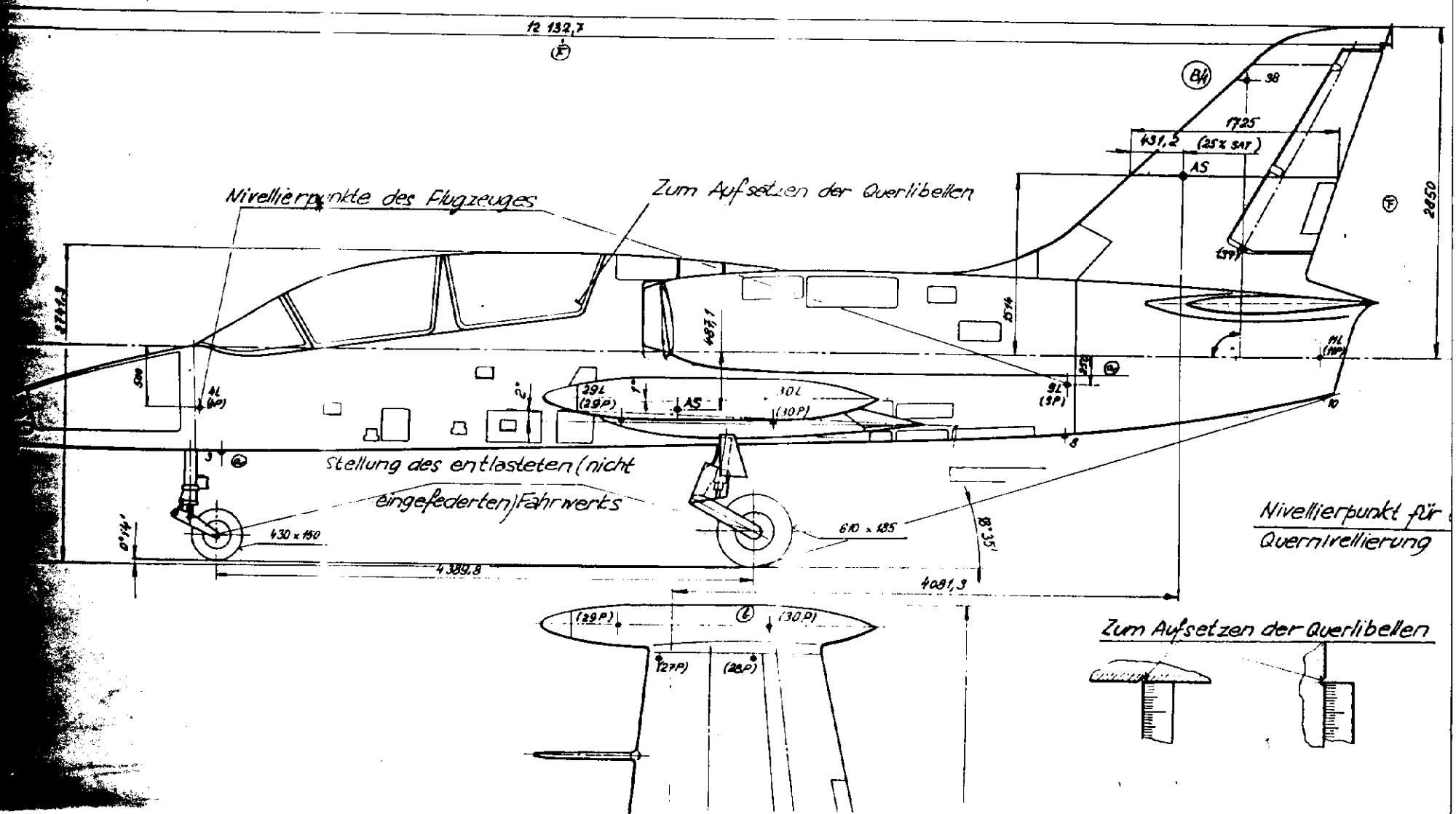
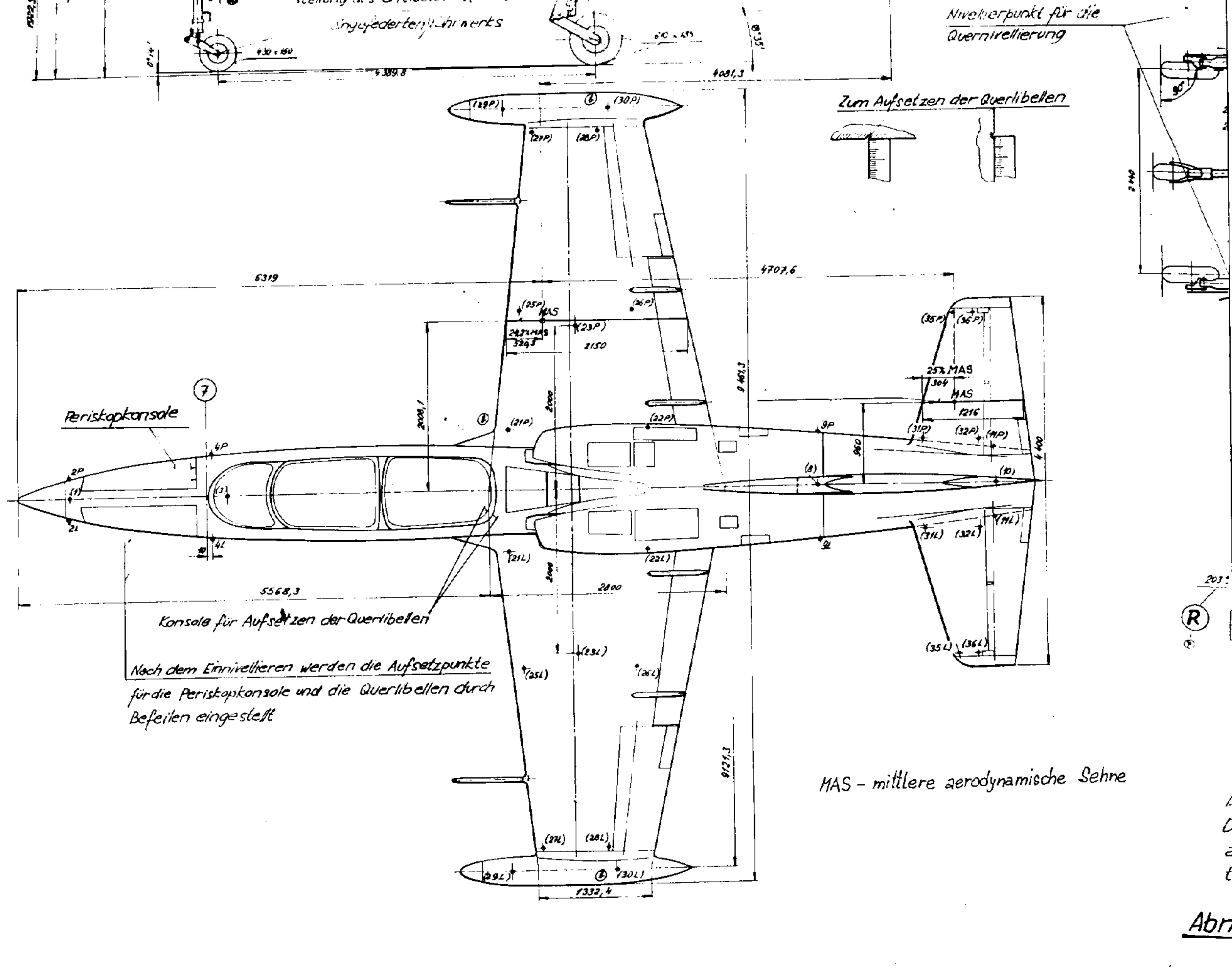
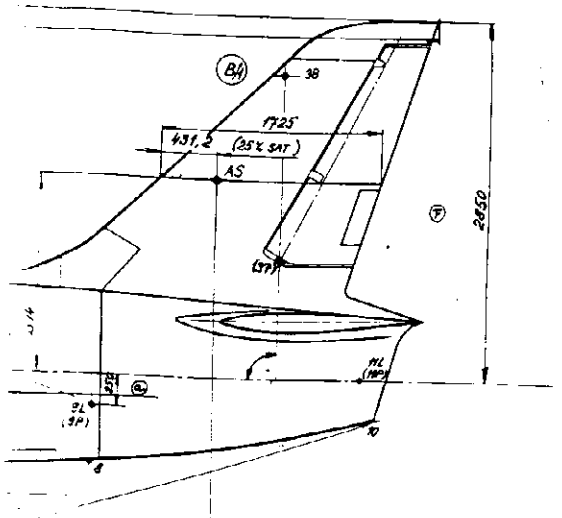
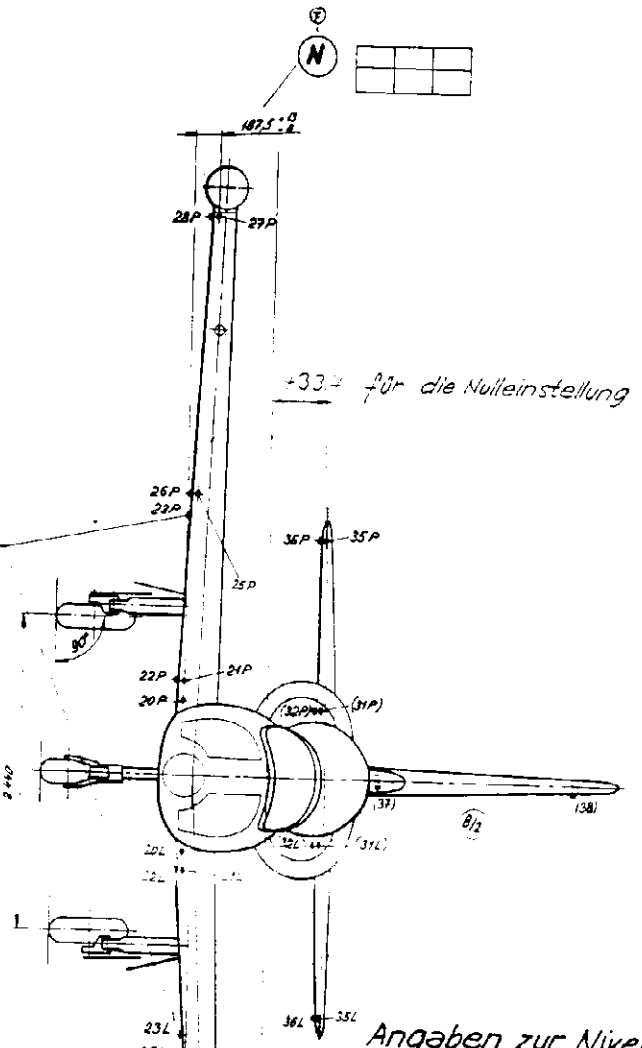


FIG.2. AFT COCKPIT


12 132,7
Nivellierpunkte des Flugzeuges
Zum Aufsetzen der Querlibellen
Stellung des entlasteten (nicht eingefederten) Fahrwerks
Nivellierpunkt für Quernivellierung
Zum Aufsetzen der Querlibellen
1725
431,2 (25% SAT)
AS
2650
4389,8
4091,3
610 x 185
430 x 150
8° 35'
0° 14'
(29P)
(30P)
(27P)
(28P)


Niveilierpunkt für die Quernivellierung
Zum Aufsetzen der Querlibellen
Periskopkonsole
Konsole für Aufsetzen der Querlibellen
Nach dem Einnivellieren werden die Aufsetzpunkte für die Periskopkonsole und die Querlibellen durch Befeilen eingestellt
MAS - mittlere aerodynamische Sehne
6319
4707,6
5568,3
2008,1
2000
2150
2800
9461,3
9121,3
1332,4
25% MAS
304
1216
960
4400
4389,8
4081,3
2440

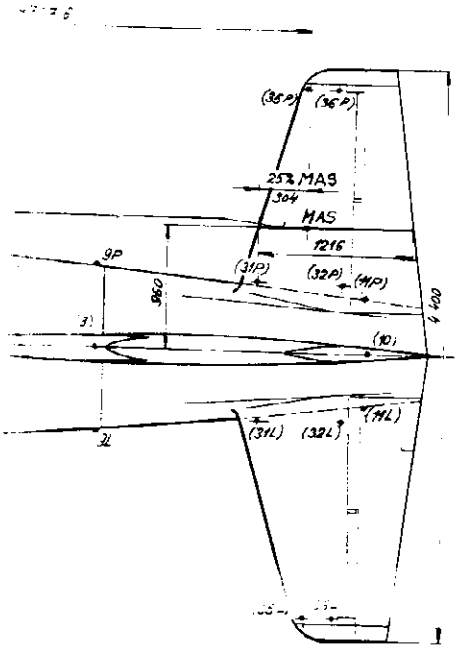




+33,4 für die Nulleinstellung der Höhenflosse

Nivellierpunkt für die Querniveillierung

Zum Aufsetzen der Querlibellen



MAS – mittlere aerodynamische Sehne

Angaben zur Nivellierung

in Maßeinheit		
Tragflügel (einschließlich Rumpfanteil)		18,8
Querruder vor der Drehachse 2 x 0,227	0,454	1,686
Querruder hinter der Drehachse 2 x 0,616	1,232	
Landeklappen 2 x 1,342		2,684
Höhenflossen		3,644
Höhenruder		1,429
Höhenruder		5,073
Seitenflosse bis zum Rumpfkontur ohne Ansätze		2,57
Seitenruder vor der Drehachse	0,20	
Seitenruder hinter der Drehachse	0,714	0,914
Seitenleitwerk		3,484
Hilfsruder der Querruder 2 x 0,0464		0,0928
Hilfs- und Trimmruder des Höhenruders		0,0874
Bremsklappen		0,500
Hilfsruder des Seitenruders		0,043

Alle Abmessungen und Daten sind theoretische Werte. Die Hauptmaße des Flugzeuges werden nur zur Information angegeben (ohne Toleranzen) Die Maße setzen ein entlastetes (nicht eingefedertes) Fahrwerk voraus.

Abmessungen des Flugzeuges

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION

SPECIAL AIRWORTHINESS CERTIFICATE

A	CATEGORY/DESIGNATION	EXPERIMENTAL	
	PURPOSE	EXIBITION	
B	MANU-FACTURER	NAME N/A	
		ADDRESS N/A	
C	FLIGHT	FROM N/A	
		TO N/A	
D	N— 39TZ		SERIAL NO. 5234
	BUILDER AERO VODOCHODY		MODEL L39CT
E	DATE OF ISSUANCE 8/16/96		EXPIRY UNLIMITED
	OPERATING LIMITATIONS DATED 8/16/96		ARE A PART OF THIS CERTIFICATE
	SIGNATURE OF FAA REPRESENTATIVE [redacted]		DESIGNATION OR OFFICE NO.
	Karen Perkins ASI (MFG)		SW MIDO-41

Any alteration, reproduction or misuse of this certificate may be punishable by a fine not exceeding $1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE FEDERAL AVIATION REGULATIONS.

FAA FORM 8130-7 (10/82)

SEE REVERSE SIDE

US Department of Transportation
Federal Aviation Administration

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
OMB No. 2120-0020

For FAA Use Only

Office Identification

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. 1421). Failure to report can result in a civil penalty not to exceed $1,000 for each such violation (Section 901 Federal Aviation Act of 1958).

1. Aircraft	Make: AERO VODOCHODY	Model: L39CT
	Serial No.: 5234	Nationality and Registration Mark: N39TZ
2. Owner	Name *(As shown on registration certificate)*: SUNDANCE AVIATION INC.	Address *(As shown on registration certificate)*: 12210 N Sara Rd. Yukon, Ok. 73099 8223

3. For FAA Use Only

INFORMATION ONLY

4. Unit Identification / **5. Type**

Unit	Make	Model	Serial No.	Repair	Alteration
AIRFRAME	*(As described in Item 1 above)*				XX
POWERPLANT					
PROPELLER					
APPLIANCE	Type / Manufacturer				

6. Conformity Statement

A. Agency's Name and Address	B. Kind of Agency	C. Certificate No.
AAR OKLAHOMA INC. 6611 S. Meridian Oklahoma City, Oklahoma 73159	[ ] U.S. Certificated Mechanic [ ] Foreign Certificated Mechanic [X] Certificated Repair Station [ ] Manufacturer	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

Date	Signature of Authorized Individual
8-15-96	[redacted]

7. Approval for Return To Service

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

BY						
	FAA Flt. Standards Inspector		Manufacturer		Inspection Authorization	Other *(Specify)*
	FAA Designee	X	Repair Station		Person Approved by Transport Canada Airworthiness Group	

Date of Approval or Rejection	Certificate or Designation No.	Signature of Authorized Individual
8-15-96		[redacted]

FAA Form 337 (12-88)

AFTT: 11.2 MODEL: L-39TC DATE: 8-14-96
LDGS: 19 S/N: 5234 N NBR: 39TZ

AIRCRAFT WAS WEIGHED AFTER ALL WORK, MODIFICATIONS AND INSTALLATION WERE PERFORMED. REFERENCE FLIGHT MANUAL FOR WEIGHT AND BALANCE INFORMATION. THERE ARE NO AIRWORTHINESS DIRECTIVES OR MANDATORY SERVICE BULLETINS. APPLICABLE TO THIS AIRCRAFT OR ITS SYSTEMS AT THIS TIME.

MAINTENANCE RELEASE

I CERTIFY THAT THIS AIRCRAFT HAS BEEN INSPECTED IAW THE PROCEDURES OF THE FEDERAL AVIATION ADMINISTRATION AND THE AIRCRAFT APPROVED INSPECTION PROGRAM AND WAS FOUND TO BE IN A CONDITION FOR SAFE FLIGHT. REFERENCE TURBO JET INC. WORK ORDER 2960.

SIGNED:_____

FOR: TURBO JET, INC. *CRS TQJR007K

AIRFRAME LOG ENTRY **PAGE 1 OF 2**

AFTT: 11.2 MODEL: L-39TC DATE: 8-14-96
LDGS: 19 S/N: 5234 N NBR: 39TZ

ASSEMBLE WING AND TAIL SECTIONS TO THE FUSELAGE IAW MANUFACTURES TECHNICAL MANUALS. RELOCATED BATTERY FROM STATION 36.0 TO STATION 14.5. INSPECTED STRUCTURE AND FABRICATED BATTERY BOX. RETAINED VENT SYSTEM. INSTALLED NEW CONCORDE SEALED BATTERY, P/N RG400E S/N CBC-251936. CONVERTED NITROGEN AND OXYGEN SERVICE BOLTS TO U.S. STANDARD FITTINGS. INSTALLED PLACARDS ON ALL APPLICABLE SWITCHES AND INSTRUMENTS. INSTALLED CONVERSION CHART. INSPECTED AND CHECKED FLIGHT CONTROL RIGGING AND TRAVEL IAW MANUFACTURES AIRCRAFT SPEC DATA. DEACTIVATED FORWARD AND AFT EJECTION SEATS AND CANOPIES. PLACARD INSTRUMENT PANELS "CANOPY, EJECTION SEAT INACTIVE". A U.S. COMMUNICATION AND NAVIGATION SYSTEM WAS INSTALLED. REFERENCE THIS AIRFRAME LOG BOOK FOR DETAILS. INSTALLED A SHADIN ELECTRONIC FUEL FLOW SYSTEM IAW MANUFACTURES INSTALLATION INSTRUCTIONS, REFERENCE FLIGHT MANUAL FOR OPERATIONAL INSTRUCTIONS. AIRFRAME AND ITS SYSTEMS WERE DEPRESERVED AND ALL SYSTEMS WERE SERVICED AND LUBRICATED IAW MANUFACTURES RECOMMENDED FLUIDS. INSTALLED A FLIGHT HOUR METER IN NOSE SECTION TO BE OPERATIONAL WHEN LANDING GEAR IS OFF THE GROUND. INSTALLED 230 LITER LONG RANGE FUEL TIP TANKS SUPPLIED BY AERO VODOCHODY IAW MANUFACTURES DRAWINGS AND INSTRUCTIONS. PERFORMED THE FOLLOWING INSPECTIONS IAW THE AIRCRAFT APPROVED INSPECTION PROGRAM. PREFLIGHT INSPECTION, PRELIMINARY PREPARATION FOR OPERATION INSPECTION, SIX AND TWELVE MONTH INSPECTIONS, 50, 100, 200, 400 HOUR INSPECTIONS. PERFORMED OPERATIONAL AND FUNCTION TESTS ON ALL SYSTEMS. CHECKED OK.

-CONTINUED-

ENGINE LOG ENTRY

AFTT: 11.2 MODEL: A1 25 TL DATE: 8-14-96
LDGS: 19 S/N: 7082523000102 N NBR: 39TZ

PERFORMED A SIX AND TWELVE MONTH, 50, 100, 200, 400 HOUR INSPECTIONS IAW AIRCRAFT APPROVED INSPECTION PROGRAM. DEPRESERVED ENGINE AND SERVICED WITH ROYCO 481 MIL-L-6081C GRADE 1010 TURBINE OIL. INSPECTED ENGINE FUEL AND OIL FILTERS BEFORE AND AFTER ENGINE PERFORMANCE GROUND RUN. NO LEAKS NOTED.

MAINTENANCE RELEASE

I CERTIFY THAT THIS ENGINE HAS BEEN INSPECTED IAW THE PROCEDURES OF THE FEDERAL AVIATION ADMINISTRATION AND THE AIRCRAFT INSPECTION PROGRAM AND WAS FOUND TO BE IN A CONDITION FOR SAFE FLIGHT. REFERENCE TURBO JET, INC. WORK ORDER 2960 FOR DETAILS.

SIGNED:_____

FOR: TURBO JET, INC. *CRS TQJR007K

Original Copy of Original

AAR OKLAHOMA, INC. will rogers world airport • 6611 south meridian • oklahoma city, oklahoma 73159 • (405) 681-3000

MODEL L39CT
S/N 5234
REG. N39TZ

DATE 8-19-96
W.O. # 6937
TACH
T.T. 11.2

Installed Collins VHF-20/CTL-20 Comm System & antenna, Collins VIR-30A/CTL-30 Nav System, ComantCI-507 VOR/GS diplexer and a Comant CI-118-5 Marker antenna. Installed a Collins TDR-90/CTL-90 Transponder system, a Collins P/N 101 Compass System, 323A-2G Flux alve and a 332E-4 D.G. Installed a S-TEC 50 2 Axis A/P system, a Shadin AMS-2000 Altitude Alerter system, an Ameri-King AK35050 Alt. Encoder, a PS Engineering PM1000II intercom system interface with Bose Headphones. Installed a Gamin GPS-250 GPS/Comant system with a GA-56 GPS antenna and a Comant CI-211 Comm antenna. Installed a Baker M1091 Audio Summing unit, a Collins DME-40/IND-40B DME system, Kollsman front and rear cockpit altimeters. Installed provisions for a AI-803/PS823A stand by Attitude Horizon system and a Shadin 912045TD Fuel Flow system. See FAA form 337 dated 8-15-96.

Signed [redacted]
AAR OKLAHOMA INC. CRS JR2R936K

AAR OKLAHOMA, INC.

T.T. 11.2

AERO L39
S/N 5234
N39TZ

DATE 8-13-96 THE PITOT AND STATIC SYSTEMS TESTS AND ATC TRANSPONDER TEST AND INSPECTION REQUIRED BY F.A.R. 91.411 AND APPENDIX E AND F OF F.A.R. PART 43, HAVE BEEN PERFORMED.
THE ALTIMETERS HAVE BEEN CERTIFIED TO 45,000 FT.
W.O. 6937 L/R S/N AF55-304 R/H S/N 50-707
Transponders # 1 S/N 1190 # 2 S/N N/A
Signe[redacted] Date 8-13-96
AAR OKLAHOMA INC. FAA-CRS JR2R936K

Will Rogers World Airport
6611 South Meridian - [redacted]
Oklahoma City, Oklahoma 73159

AERO VODOCHODY L-39
CONVERSION CHART

1 MM of Mercury - 1.3332 MB
1 KG = 2.205 LBS
1 KG = 1.28 LITERS
1 LITER = 0.255 GAL
1 LITER = 0.78 KG
KP/CM2 = 14.223 PSI
1"HG = 0.4912 PSI
1 KT = 1.852 KM/HR
1 KT = 1.688 FT/SEC
1 KM = 0.5359
KM x 0.53959 = KTS
KTS x 1.853 = KM
FT x 0.304801 = M
M x 3.28083 = FT
1 GAL JET A = 6.777 LBS
10 M/SEC = 19.40 KTS
1 KP = 2.2 LBS THRUST

QUICK REFERENCE ITEMS

Basic Empty Weight		7,450 LBS
Max Take-Off Weight		10,600 LBS
Max Fuel Fuselage	289 GALS	1,936 LBS
-Tip Tanks (Normal)	52 GALS	352 LBS
-Tip Tanks (Style 2301)	126 GALS	854 LBS
Max Landing. Weight		10,138 LBS
Max Thrust (Sea Level ISA)		3,790 LBS
Max Airspeed (IAS)		491 KTS
Max Mach (± .02 Mach) Airbrake Auto Deploy		.78 Mach
Max Ceiling		36,100 FT
Max Rate of Climb		4,330 FT/MIN
C.G. Range		20-27% MAC
Max Inverted Flight		20 SECS
Wait 15 SECS to Recharge Accumulator		
Max Crosswind Component		15 KTS
Max Wheel Speed		130 KTS
Max Taxi Speed		16 KTS
Max Taxi (Turn) Speed		8 KTS

LIMITATIONS

Nose Tire Pressure		50 PSI
Main Tire Pressure		65 PST
Fuel Pressure		(Max) 65 KPC Squared
Oil Pressure		(Max) 4.5 KPC Squared
Oil Temperature	-40C to 90C (Max)	Starting Limitation
	-5C to 90C (Max)	Operating Limitation
Tach (N2) (HPC)		(Max) 106.8% ± 1%
Hydraulic Pressure (Normal & Emer.)		(Max) 150 KPC Squared

ENGINE

Ivchenko AI 25TL Turbofan	2:1 By Pass Ratio
Max Thrust (ISA, Sealevel)	3790 LBS
ITT	(Max) 730C
Service Life	(Max) 4000 Hours
Overhaul	(Max) 1000 Hours or 6 Years
Pressurization	3.2 Inches Pressure Differential

HYDRAULIC OPERATION

Hydraulic Pressure (Max) 2175 LBS

Operates:
- Landing Gear
- Landing Gear Doors
- Landing & Takeoff Flaps
- Air Brakes
- Ram Air Turbine
- Wheel Brakes

ELECTRICAL

THREE SOURCES:

Battery	24V (9KW)
Main DC Generator	28V (9KW)
Ram Air Turbine	28V (9KW)

SAPHIRE 5

Max Alt Operation	20,000 FT
Engine Starts For Each Running Cycle	3 Starts
Wait 30 SECS Between Starts, 30 MINS Between Cycles	
Saphire Cranks Engine To	24%
Saphire Cut-Off	43%
Ivchenko Idle	56%

TURBO JET, INC. 12210 N. Sara Road
"The Aircraft Maintenance Specialist" Yukon, Oklahoma 73099
[redacted] FAX: (405) 373-1228

AIRFRAME LOG ENTRY

AFTT: 116.1 MODEL: L-39CT DATE: 10/18/00
H.M.: 116.1 S/N: 5334 N NBR: 602MC

---

1. PERFORMED A PREFLIGHT 6/12 MONTH, 50/100 HOUR INSPECTIONS IAW CUSTOMER APPROVED AIRCRAFT INSPECTION PROGRAM.
2. **REMOVED 200 LBS OF BALLAST INSTALLED IN AIRCRAFT** 10/12/99 TO CONFIGURE AIRCRAFT TO ORIGINAL WEIGHT AND BALANCE. REWEIGHED AIRCRAFT, REFERENCE FLIGHT MANUAL FOR CURRENT WEIGHT AND BALANCE DATED 10/17/00.
3. PARACHUTES CERTIFIED BY DENNIE DARNELL CERTIFICATE NUMBER 1869202JPU, FWD S/N, 83-025021, AFT S/N 83-015324.
4. REPLACED HYDRAULIC FILTERS.
5. PERFORMED SATISFACTORY GEAR RETRACTION TESTS.
6. REPLACED LEFT AND RIGHT LANDING LIGHTS.
7. REINSTALLED CANOPIES AFTER POLISHING.
8. TREATED AIRCRAFT WITH CORROSION X.
9. REPAIRED MISC PANEL LIGHTS.
10. REPLACED TURBO COOLER SOCK AND CLAMPS.
11. SERVICED TURBO COOLER.
12. SERVICED AIR STARTER.
13. SERVICED OXYGEN.
14. SERVICED NITROGEN.
15. SERVICED HYDRAULIC RESERVOIR.
16. SERVICED PNEUMATIC DESCANT JAR.

PAID

-CONTINUED-

Inactivity Inspect
Don D
Don Dewey

TURBO JET, INC. 12210 N. Sara Road
"The Aircraft Maintenance Specialist" Yukon, Oklahoma 73099
[redacted] FAX: (405) 373-1228

AIRFRAME LOG ENTRY

AFTT: 116.1	MODEL: L-39CT	DATE: 10/18/00
H.M.: 116.1	S/N: 5334	N NBR: 602MC

17. REPLACED AIR CONDITIONER FILTER.
18. REPLACED RIGHT OUTBOARD WHEEL BEARING.
19. CLEANED FUEL SCREENS.
20. CHECKED GENERATOR BRUSHES.
21. DETAILED AIRCRAFT.
22. AIRCRAFT WAS TEST FLOWN, ALL SYSTEMS OPERATED NORMALLY.

MAINTENANCE RELEASE

I CERTIFY THAT THIS AIRFRAME HAS BEEN INSPECTED IN ACCORDANCE WITH THE PROCEDURES OF THE FEDERAL AVIATION ADMINISTRATION AND THE AIRCRAFT APPROVED INSPECTION PROGRAM AND WAS FOUND TO BE IN A CONDITION FOR SAFE FLIGHT. REFERENCE TURBO JET, INC. WORK ORDER 00-4260 DATED 10/18/00 FOR DETAILS.

SIGNED: [redacted]
FOR: TURBO JET, INC. *CRS TQJR007K

REGISTRATION NOT TRANSFERABLE

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION
CERTIFICATE OF AIRCRAFT REGISTRATION

This certificate must be in the aircraft when operated.

NATIONALITY AND REGISTRATION MARKS **N602MC**

AIRCRAFT SERIAL NO.
135234

MANUFACTURER AND MANUFACTURER'S DESIGNATION OF AIRCRAFT
AERO VODOCHODY L39CT

ICAO Aircraft Address Code: 51747703

ISSUED TO

MAC FLIGHTLEASE INC
1828 NW MILLER RD
PORTLAND OR 97229-7505

CORPORATION

This certificate is issued for registration purposes only and is not a certificate of title. The Federal Aviation Administration does not determine rights of ownership as between private persons.

It is certified that the above described aircraft has been entered on the register of the Federal Aviation Administration, United States of America, in accordance with the Convention on International Civil Aviation dated December 7, 1944, and with the Federal Aviation Act of 1958, and regulations issued thereunder.

U.S. Department of Transportation
Federal Aviation Administration

DATE OF ISSUE
December 16, 1997

[redacted] ADMINISTRATOR

AC Form 8050-3(8/97) Supersedes previous editions

TURBO JET, INC.
SUNDANCE AIRPARK
12210 NORTH SARA ROAD
YUKON, OK 73099
CRS: TQJR007K

PHN: 405/373-1278
FAX: 405/373-3893

WORK ORDER 00-4260 Page: -1- of 9

N No: 602MC S/N: 5234

Invoice Nbr: 00-4260
Date Received: 10/02/00
Estimated Delivery: 10/06/00
Written By: CURTIS MORPHEW

Owner: MAC FLIGHT LEASE INC.
538 COMMONS DR.
DENVER, CO. 80401

-----Phone-----
303
526-35430FC
303

Make.: AERO
Model: L-39CT
N No.: 602MC
S/N..: 5234

AFTT: 116.1
H.M.: 116.1
L-Eng TSN: 116.1
R-Eng TSN:

LDGS:
CSN: TSO:
CSN: TSO:

MAINTENANCE RELEASE

The Aircraft identified above/~~below~~ was repaired and inspected in accordance with current instructions contained in Owner AAIP + Maintenance Manual / the Maintenance Rules of the Federal Aviation Regulation under with the operator is certificated and is approved for return to service as per those requirements. Pertinent details of the repair are on file at this repair station under Work Order Nbr: 00-42 Dated 10-18-2000

Signed [redacted] for TURBO JET, INC. 12916 N. Sara Road, Yukon, OK 73099 CRS TQJR007K.

ITEM DESCRIPTION | Mech. | Insp.

[1] PERFORM 6 MONTH/50 HOUR AND 12 MONTH/100 HOUR INSPECTIONS

Disp: C/W 6 MONTH/50 HR INSPECTION IAW AAIP.
C/W 12 MONTH/100 HR INSPECTION IAW AAIP
A/C WAS POST INSPECTION FLIGHT TESTED BY TOM KERSTING, NO DEFECTS NOTED.

TOTAL TIME:

P/N OFF: S/N OFF: P/N ON: S/N ON:

Removed / Repaired / Reinstalled / Function Test / Completed

ITEM DESCRIPTION | Mech. | Insp.

[2] PERFORM FAR 91.411 AND 91.413 PITOT STATIC

Disp: C/W by Advanced Avionics per Customer Request.
Also Reference Item #34

TOTAL TIME:

P/N OFF: S/N OFF: P/N ON: S/N ON:

Removed / Repaired / Reinstalled / Function Test / Completed

ITEM DESCRIPTION | Mech. | Insp.

[3] REMOVE CANOPIES FOR RETAINER STRIP AND POLISH

Disp: Removed FWD + AFT canopies for Polish By Downtown Airpark. Reinstalled

TOTAL TIME:

P/N OFF: S/N OFF: P/N ON: S/N ON:

Removed / Repaired / Reinstalled / Function Test / Completed

TURBO JET, INC.
SUNDANCE AIRPARK PHN: 405/373-1278
12210 NORTH SARA ROAD
YUKON, OK 73099 FAX: 405/373-3893
CRS: TQJR007K

WORK ORDER 00-4260 Page: -2- of 9

N No: 602MC S/N: 5234

Invoice Nbr: 00-4260
Date Received: 10/02/00
Estimated Delivery: 10/06/00

Written By: CURTIS MORPHEW

ITEM DESCRIPTION — Mech. | Insp.

[4] REMOVE BALLAST WEIGHTS IN NOSE COMPARTMENT, Pilot Report A/C To Nose Heavy.

Disp: Removed 4 each Ballast from nose Section due TO Improper Installation (non approved Hardware). Reweighed Aircraft, Ref Item 26. (50 lbs each Removed 200 Total)

TOTAL TIME:

P/N OFF: S/N OFF: P/N ON: S/N ON:

Removed MK | Repaired | Reinstalled MK | Function Test | Completed MK

ITEM DESCRIPTION — Mech. | Insp.

[5] REMOVE PARACHUTES FOR CERTIFICATION

Disp: Removed chutes And ship to Dennis Darrell for Recert. new owner. Reinstalled after Certification.

FWD 50C7024-22 S/N 83-025021
AFT 50C7024-22 S/N 83-015324

TOTAL TIME:

P/N OFF: FWD 50C7024-22 / AFT 50C7024-22 S/N OFF: S/N 83-025021 / S/N 83-015324 P/N ON: SAME S/N ON: SAME

Removed MK | Repaired | Reinstalled MK | Function Test | Completed MK

ITEM DESCRIPTION — Mech. | Insp.

[6] UNDERCARRIAGE LIGHTS INTERMITTENT (AFT COCKPIT)

Disp: Removed Bulb + cleaned, Reinstalled ops ✓ OK

TOTAL TIME:

P/N OFF: S/N OFF: P/N ON: S/N ON:

Removed MK | cleaned Repaired MK | Reinstalled MK | Function Test MK | Completed MK

ITEM DESCRIPTION — Mech. | Insp.

[7] LEFT LANDING LIGHT INOP (TAXI OK)

Disp: Installed new Light Bulb

TOTAL TIME:

P/N OFF: 28-200130-1 S/N OFF: n/a P/N ON: 28-200130-1 S/N ON: n/a

Removed MK | Repaired | Reinstalled MK | Function Test MK | Completed MK

ITEM DESCRIPTION — Mech. | Insp.

[16] AFT INTERCOMM SWITCH COVER LOOSE — Removed

Disp: Tighten cover — Repaired mm

Reinstalled

TOTAL TIME: — Function Test mm

P/N OFF: S/N OFF: P/N ON: S/N ON: — Completed mm

ITEM DESCRIPTION — Mech. | Insp.

[17] SERVICE TURBO COOLER RESERVIOR — Removed mm

Disp: Serviced Turbo Cooler with Mobil Jet II Turbine oil — Repaired

Reinstalled mm

TOTAL TIME: — Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: — Completed mm

ITEM DESCRIPTION — Mech. | Insp.

[18] SERVICE NITROGEN — Removed mm

Disp: Serviced nitrogen — Repaired

Reinstalled mm

TOTAL TIME: — Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: — Completed mm

ITEM DESCRIPTION — Mech. | Insp.

[19] SERVICE OXYGEN — Removed mm

Disp: Serviced Oxygen — Repaired

Reinstalled mm

TOTAL TIME: — Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: — Completed mm

ITEM DESCRIPTION | Mech. | Insp.

[24] SAPPHIRE IGNITOR WORN — Removed MP

Disp: Installed new Ignitor Plug — Repaired

Reinstalled MP

TOTAL TIME: Function Test MP

P/N OFF: S/N OFF: P/N ON: N48F-3 S/N ON: Completed MP

ITEM DESCRIPTION | Mech. | Insp.

[25] FUEL FLOW COMPENSATOR NOT SAFETIED — Removed

Disp: SAFETIED AS Required — Repaired

Reinstalled MP

TOTAL TIME: Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: Completed MP

ITEM DESCRIPTION | Mech. | Insp.

[26] WEIGH AIRCRAFT (REVERE CORP #46500 SCALES AAR) S/N 000113 — Removed MP

Disp: AIRCRAFT WEIGHED AS FOLLOWS EMPTY FUEL, OIL SERVICED. LEVELED. NOSE 2475.0; LEFT 2380; RIGHT 2480.0 — Repaired

TOTAL 7335.0. REVISED FLIGHT MANUAL. ADVISE OWNER/OPERATOR OF NEW WEIGHT + BALANCE. MUST HAVE BALLAST IN LOSE OR BAGGAGE FOR PROPER C.G. & MAC. TOTAL TIME: Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: Completed MP

ITEM DESCRIPTION | Mech. | Insp.

[27] CLEAN AND TREAT AIRCRAFT WITH CORROSION X — Removed

Disp: TREATED WINGS WITH CORROSION X — Repaired

FOR PREVENTIVE MEASURES ONLY. — Reinstalled

TOTAL TIME: Function Test

P/N OFF: S/N OFF: P/N ON: S/N ON: Completed MP

Enter Fuel Specific Gravity=	**6.75**					
L-39 Weight and Balance						
Standard Aircraft Loading						
Item	**Gallons**	**Pounds**	**Kilograms**	**Arm**	**Moment**	
Basic Empty Weight		7349	3325.3	247.60	1795439.15	
Pilot (1)		195	88.2	131.00	25545.00	
Parachute (1)		0	0.0	131.00	0.00	
Pilot (2)		180	81.4	189.00	34020.00	
Parachute (2)		0	0.0	189.00	0.00	
Baggage		0	0.0	60.00	0.00	**%MAC**
Zero Fuel C.G.		**7724**	**3494.9**	240.16	**1855004.15**	28.00%
Fuselage Fuel	290	1896	857.9	230.04	436155.84	
Fuselage Fuel C.G.		**9620**	**4352.8**	238.17	**2291159.99**	**23.28%**
Standard Tip Fuel	0	0	0.0	253.10	0.00	
Takeoff C.G.	**290**	**9620**	**4352.8**	238.17	**2291159.99**	**23.28%**

Hello Bernd:

Jim,

let's walk trough the problem...

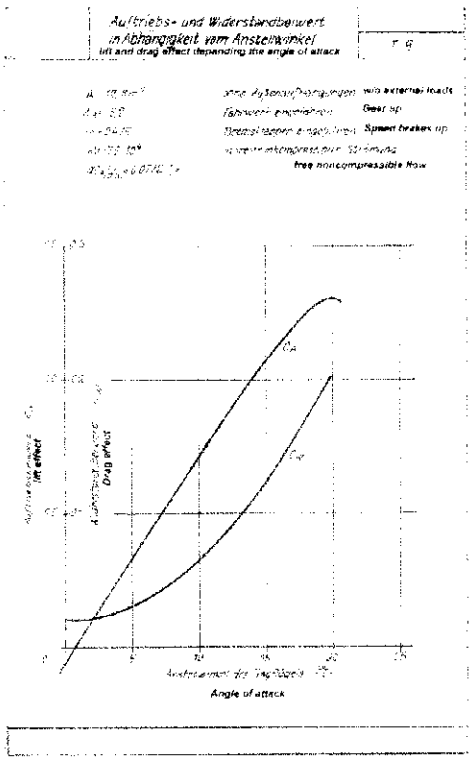
1. Those charts, as attached, are not available in English, they were posted only in the German L-39 Book 1 , " Flight Characteristics " which got more info's in it than the books circulating on the US market. (US Pilots don't need that – because they are smart....at least I think so)

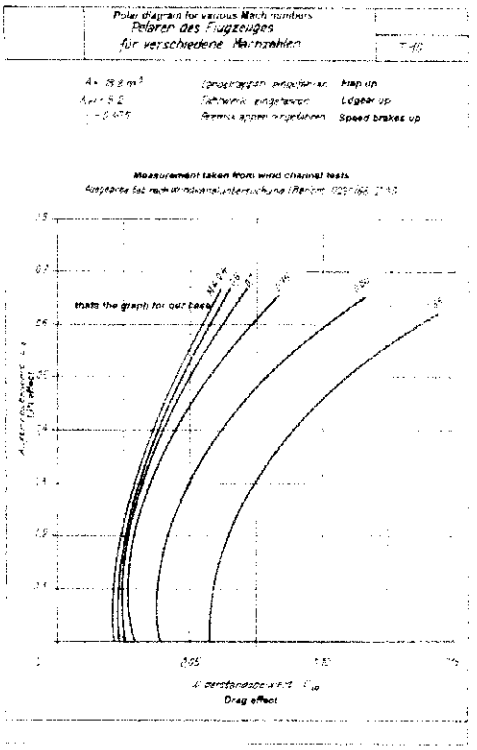
2. We had an airplane with 34,97 % (as weighed) and 34.42 % MAC as basic empty aircraft. The limits are for the C model : 21-26 % Mac
According to the turbo Jets Weight and balance sheet dd. on 10-17-00 the C/G is far aft. Mr. Hruska of Aero Vod. re-calculated the c/g for the flight on January 24th, 2001 by using the main data's taken from the TURBO JET data sheet. Using the right datum line, he found the cg at 34,98 % MAC (TURBO JET at 34,42 % MAC).

3. If the airplane is originally equipped all flight cases are covered with the valid % age of the MAC.

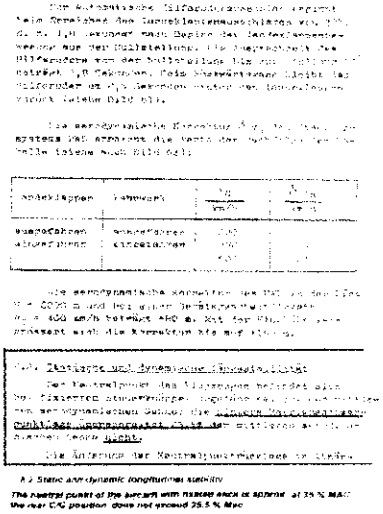
4. A modified airplane (western avionics) need a balance weight to bring the plane back within the limits. It was missing from Turbo Jets , later on installed by International Jets – correct - and later on again removed from Turbo Jets (not correct) . However , the US modified light weight L-39's are more sensitive than the standard equipped plane. Several cases of instability or other appearances can happen later or (mostly) much earlier than on a standard equipped airplane and as shown in the diagrams attached.

Here are the basic graphs :





According to the description of the Book 1 on Page 34/35/36 (red marked)

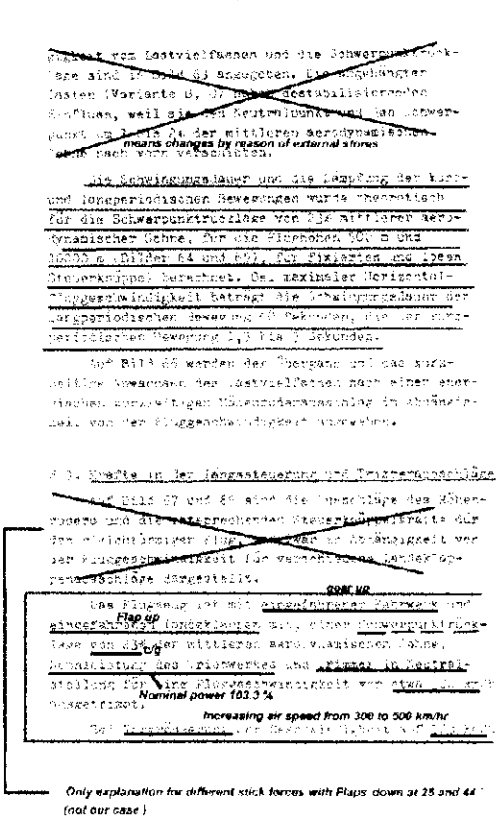


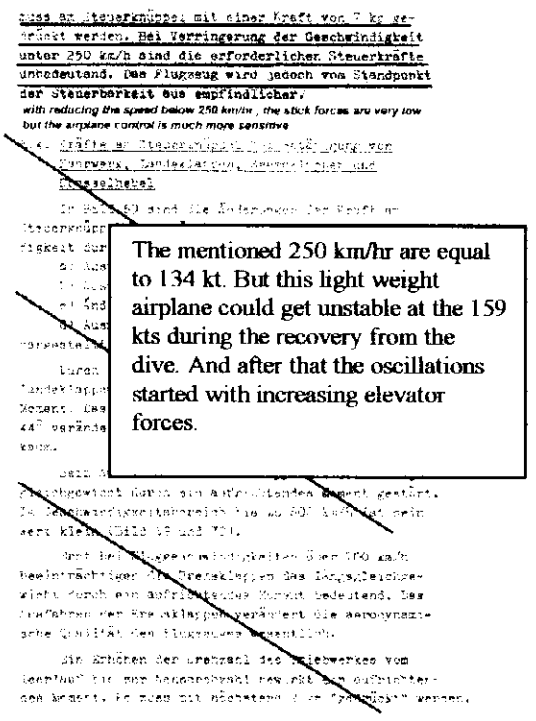
in flight

...the C/G does never exceed 25,5 % Mac if the basic empty airplane is correct within the limits and with landing gear down the airplane have to have a C/G of 27,7 +/- 0,5 %.
In our case total out of range as per the W/B sheet of Turbo Jets Inc..

5. The basic airplane (factory standards) is balanced with c/g 23 % MAC, Gear up, Flap up and engine on nominal power (103,2 % RPM) at 300 Km/hr (162 kt) and all trim tabs neutral. At this configuration the force on the stick is approx.2 kp or approx. 4 lbs. increasing the speed to 500 Km/hr (270kt) the necessary force on the stick increased to 7 Kp. (still at normal horizontal and leveled flight) (blue marked)

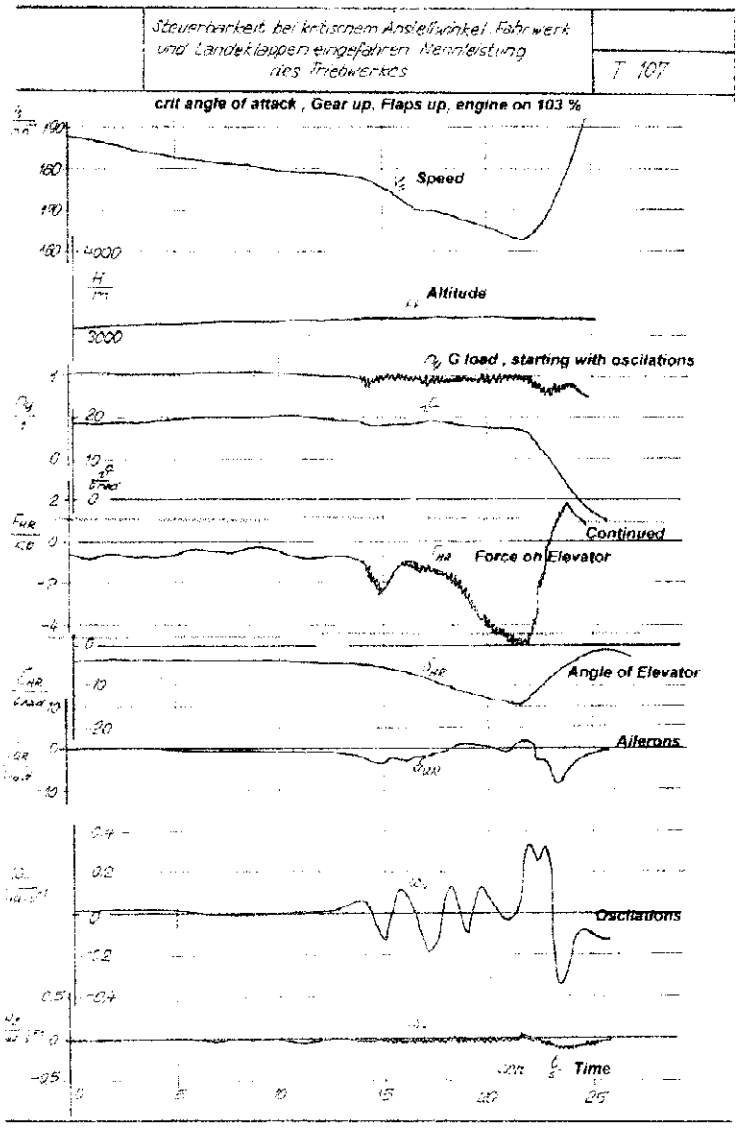
6. The Diagrams 64 and 65 are showing the self damping effect for long periodically longitudinal and short periodically longitudinal oscillations , this self damping effect is caused after a sharp and spontaneous elevator movement and can turn in one of the mentioned effects.
<u>But this will work as self damping effect only if the plane is with his c/g within the limits and at the calculated case exactly at c/g of 23 % !!!! (green marked)</u>
In the case of N 602MC the c/g was far aft and the self damping effect doesn't exist and turned in an increasing oscillating longitudinal movement with increasing stick forces.
For our case the graph of the 500 meters should apply. Since the airplane is more light weight and got an aft C/G , the mentioned effects could happen much earlier and at a lower speed , and therefore with increasing of the speed from 159 knots (dive as per radar chart) to 200 kts lead to the 30 ° pitch up - with increasing elevator stick force as well , where M.Ch. was unable to push the stick forward to damp the oscillations.





The mentioned 250 km/hr are equal to 134 kt. But this light weight airplane could get unstable at the 159 kts during the recovery from the dive. And after that the oscillations started with increasing elevator forces.

7. Picture T-107 shows the increasing forces on the elevator after he reached a critical angle of attack to bring the airplane back on level.....
I think that does not need a further explanation....



Der automatische Hilfsruderausschlag beginnt beim Erreichen des Landeklappenausschlages von 30°, d. h. 1,8 Sekunden nach Beginn der Landeklappenbewegung aus der Nullstellung. Die Ansprechzeit des Hilfsruders von der Nullstellung bis zur Stellung 15° beträgt 2,8 Sekunden. Beim Rückwärtsgang bleibt das Hilfsruder um 0,5 Sekunden hinter den Landeklappen zurück (siehe Bild 61).

Die aerodynamische Korrektur δv_a des Staurohrsystems PWD erreicht die Werte der nachfolgenden Tabelle (siehe auch Bild 62):

Landeklappen	Fahrwerk	$\frac{v_G}{km/h}$	$\frac{\delta v_a}{km/h}$
ausgefahren	ausgefahren	200	6
eingefahren	eingefahren	280	9
		600	21

Die aerodynamische Korrektur des PWD in der Höhe H = 6000 m und bei einer Gerätegeschwindigkeit v_G = 400 km/h beträgt +80 m. Mit der Flughöhe vergrössert sich die Korrektur bis auf +150 m.

8.2. Statische und dynamische Längsstabilität

Der Neutralpunkt des Flugzeuges befindet sich bei fixiertem Steuerknüppel ungefähr bei 35% der mittleren aerodynamischen Sehne; die hintere Betriebsschwerpunktlage überschreitet 25,5% der mittleren aerodynamischen Sehne nicht.

Die Änderung der Neutralpunktrücklage in Abhän-

8.2 Static and dynamic longitudinal stability

The neutral punkt of the aircarft with fixated stick is approx. at 35 % MAC the rear C/G position does not exceed 25.5 % Mac

The chnage of the N/P position is depending....

gigkeit vom Lastvielfachen und die Schwerpunktrücklage sind in Bild 63 angegeben. Die angehängten Lasten (Variante B, C) haben destabilisierenden Einfluss, weil sie den Neutralpunkt und den Schwerpunkt um 1 bis 2% der mittleren aerodynamischen Sehne nach vorn verschieben.

means changes by reason of external stores

Die Schwingungsdauer und die Dämpfung der kurz- und langperiodischen Bewegungen wurde theoretisch für die Schwerpunktrücklage von 23% mittlerer aerodynamischer Sehne, für die Flughöhen 500 m und 10000 m (Bilder 64 und 65), für fixierten und losen Steuerknüppel berechnet. Bei maximaler Horizontalfluggeschwindigkeit beträgt die Schwingungsdauer der langperiodischen Bewegung 60 Sekunden, die der kurzperiodischen Bewegung 1,5 bis 3 Sekunden.

Auf Bild 66 werden der Übergang und das kurzzeitige Anwachsen des Lastvielfachen nach einem energischen kurzzeitigen Höhenruderausschlag in Abhängigkeit von der Fluggeschwindigkeit angegeben.

8.3. Kräfte in der Längssteuerung und Trimmerausschläge

Auf Bild 67 und 68 sind die Ausschläge des Höhenruders und die entsprechenden Steuerknüppelkräfte für den gleichförmigen Flug, und zwar in Abhängigkeit von der Fluggeschwindigkeit für verschiedene Landeklappenausschläge dargestellt.

gear up

Das Flugzeug ist mit eingefahrenem Fahrwerk und eingefahrenen Landeklappen mit, einer Schwerpunktrücklage von 23% der mittleren aerodynamischen Sehne, Nennleistung des Triebwerkes und Trimmer in Neutralstellung für eine Fluggeschwindigkeit von etwa 300 km/h ausgetrimmt.

Flap up

c/g

Nominal power 103,3 %

Increasing air speed from 300 to 500 km/hr

Bei Vergrösserung der Geschwindigkeit auf 500 km/h

Only explanation for different stick forces with Flaps down at 25 and 44 °
(not our case)

muss am Steuerknüppel mit einer Kraft von 7 kp gedrückt werden. Bei Verringerung der Geschwindigkeit unter 250 km/h sind die erforderlichen Steuerkräfte unbedeutend. Das Flugzeug wird jedoch vom Standpunkt der Steuerbarkeit aus empfindlicher.

with reducing the speed below 250 km/hr, the stick forces are very low but the airplane control is much more sensitive

3.4. Kräfte am Steuerknüppel bei Betätigung von Fahrwerk, Landeklappen, Bremsklappen und Drosselhebel

In Bild 69 sind die Änderungen der Kraft am Steuerknüppel in Abhängigkeit von der Fluggeschwindigkeit durch

a) Ausfahren des Fahrwerkes
b) Ausfahren der Landeklappen
c) Änderung der Triebwerksdrehzahl
d) Ausfahren der Bremsklappen

dargestellt.

Durch das Ausfahren des Fahrwerkes oder der Landeklappen auf 25° entsteht ein kleines neigendes Moment. Das Ausfahren der Landeklappen von 25° auf 44° verändert das Längsgleichgewicht des Flugzeuges kaum.

Beim Ausfahren der Bremsklappen wird das Längsgleichgewicht durch ein aufrichtendes Moment gestört. Im Geschwindigkeitsbereich bis zu 600 km/h ist sein Wert klein (Bild 69 und 70).

Erst bei Fluggeschwindigkeiten über 700 km/h beeinträchtigen die Bremsklappen das Längsgleichgewicht durch ein aufrichtendes Moment bedeutend. Das Ausfahren der Bremsklappen verändert die aerodynamische Qualität des Flugzeuges wesentlich.

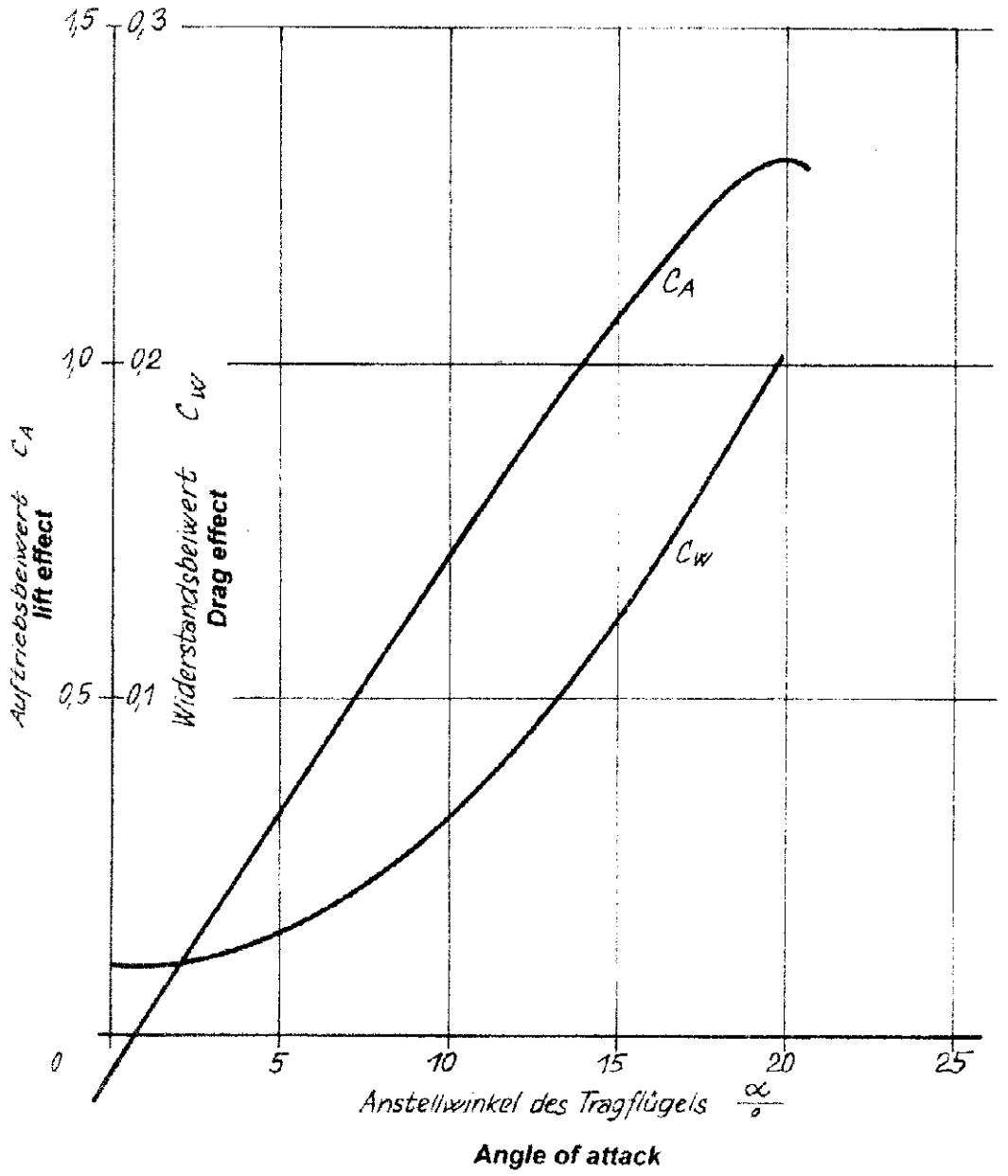
Ein Erhöhen der Drehzahl des Triebwerkes vom Leerlauf bis zur Nenndrehzahl bewirkt ein aufrichtendes Moment. Es muss mit höchstens 2 kp "gedrückt" werden.

Auftriebs- und Widerstandbeiwert in Abhängigkeit vom Anstellwinkel
lift and drag effect depending the angle of attack

T 9

$A = 18,8\,m^2$
$\Lambda_{ef} = 5,2$
$\eta = 0,475$
$Re = 7,2 \cdot 10^6$
$dc_A/d\alpha = 0,0772\ 1/°$

ohne Außenaufhängungen **w/o external loads**
Fahrwerk eingefahren **Gear up**
Bremsklappen eingefahren **Speed brakes up**
in freier inkompressibler Strömung
free noncompressible flow



Polar diagram for various Mach numbers

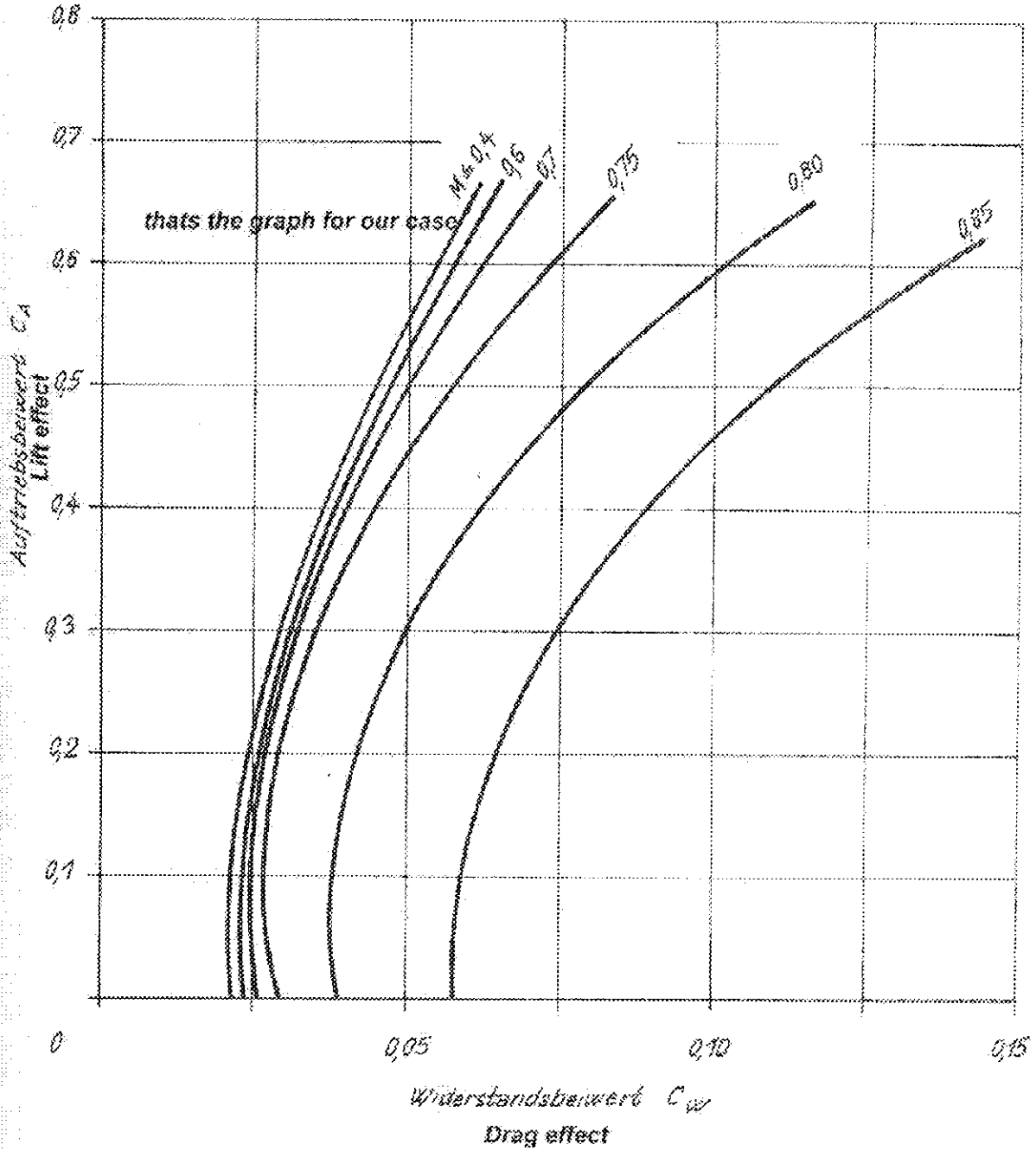
Polaren des Flugzeuges für verschiedene Machzahlen

T 10

$A = 18{,}8\ m^2$
$\Lambda_{ef} = 5{,}2$
$\eta = 0{,}475$

Landeklappen eingefahren — Flap up
Fahrwerk eingefahren — Ldgear up
Bremsklappen eingefahren — Speed brakes up

Measurement taken from wind channel tests
Ausgearbeitet nach Windkanaluntersuchung (Bericht 0230/68) ZAGI



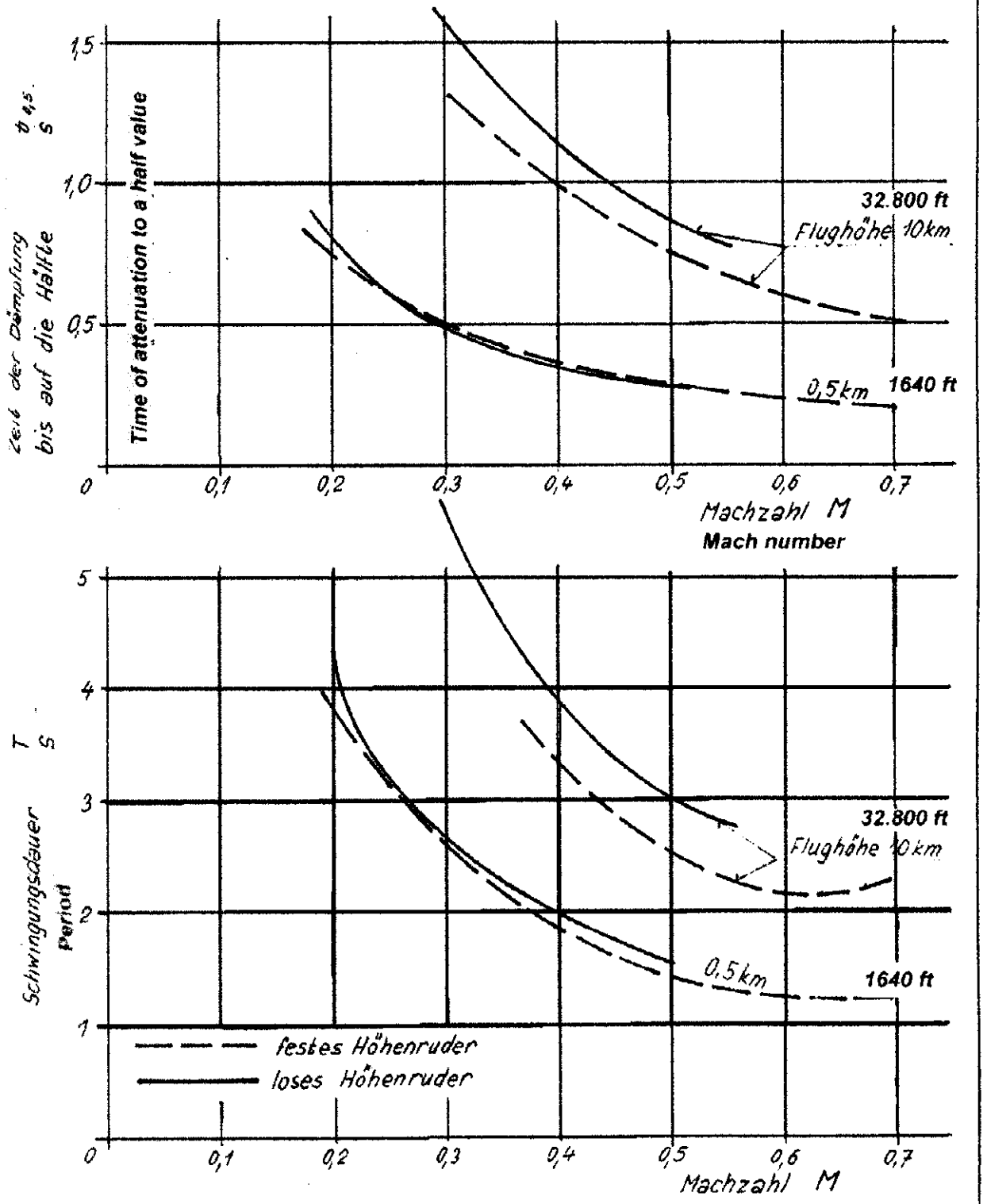
Longitudinal Stability ,
Längsstabilität ,
kurzperiodische Längsbewegung
short periodical longitudinal movement

T-65

CoG Schwerpunktlage 23% t_m

Flap up Landeklappen eingefahren

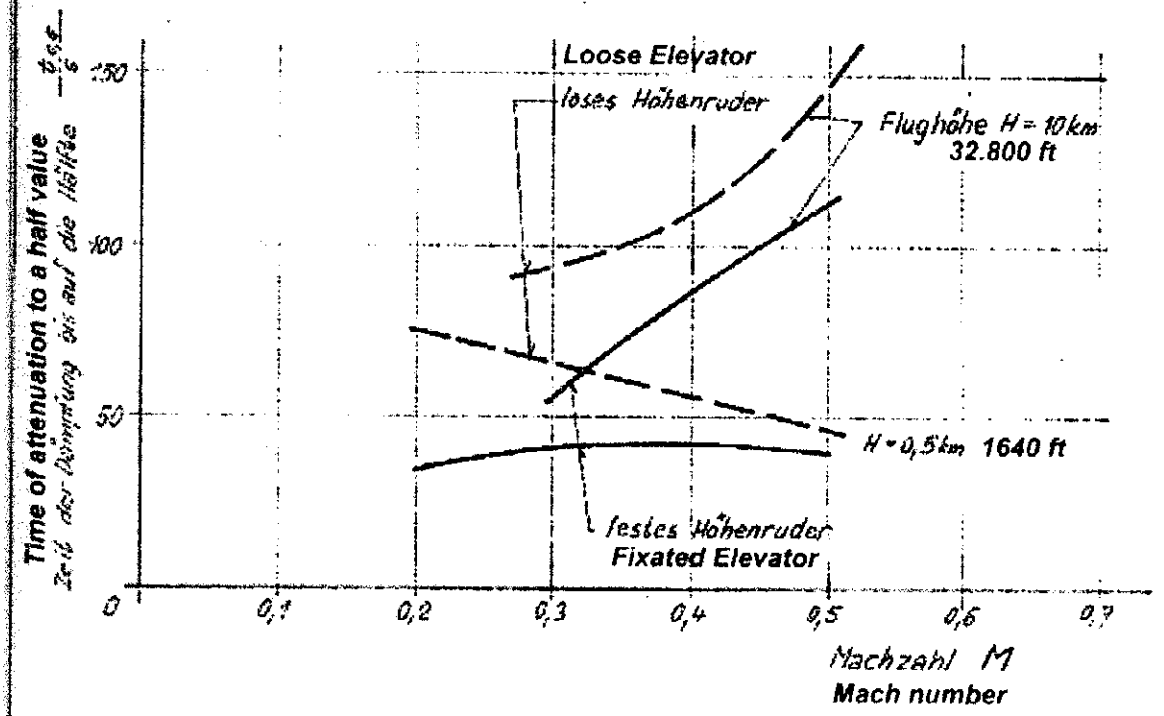
Airplane weight Masse des Flugzeuges 3600 kg

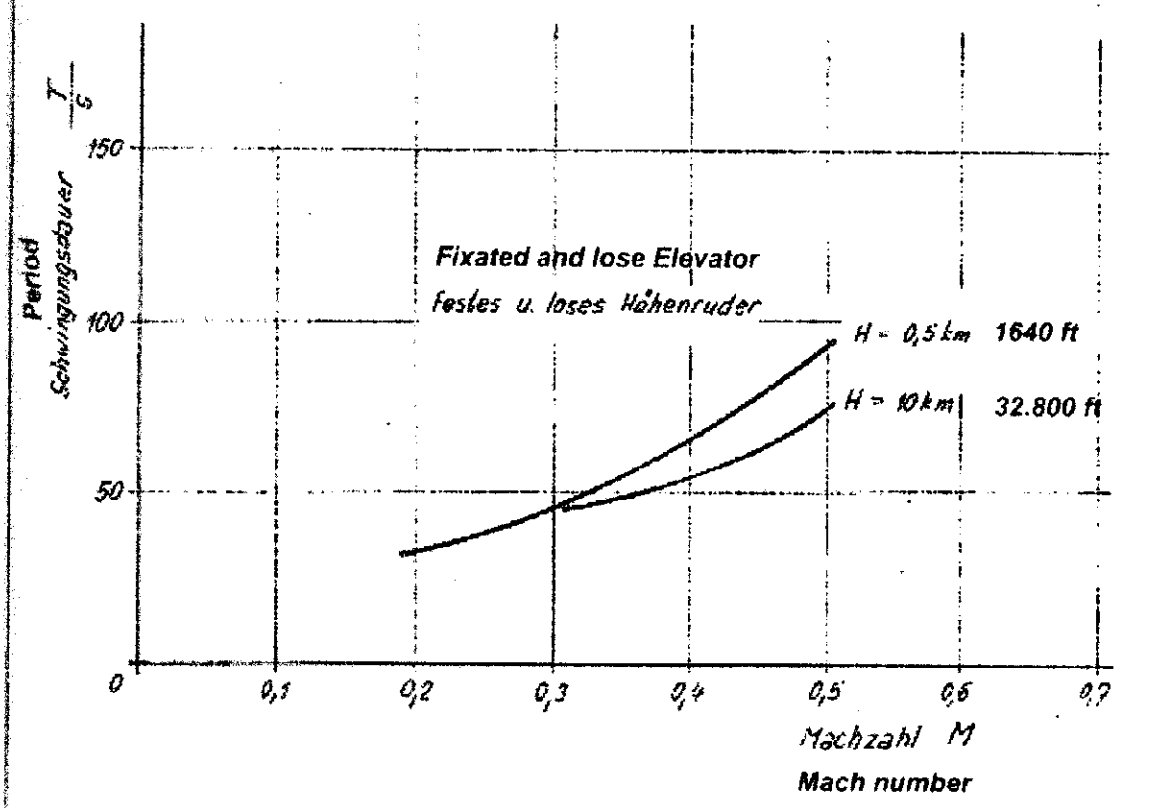


Längsstabilität, langperiodische Längsbewegung

T-64

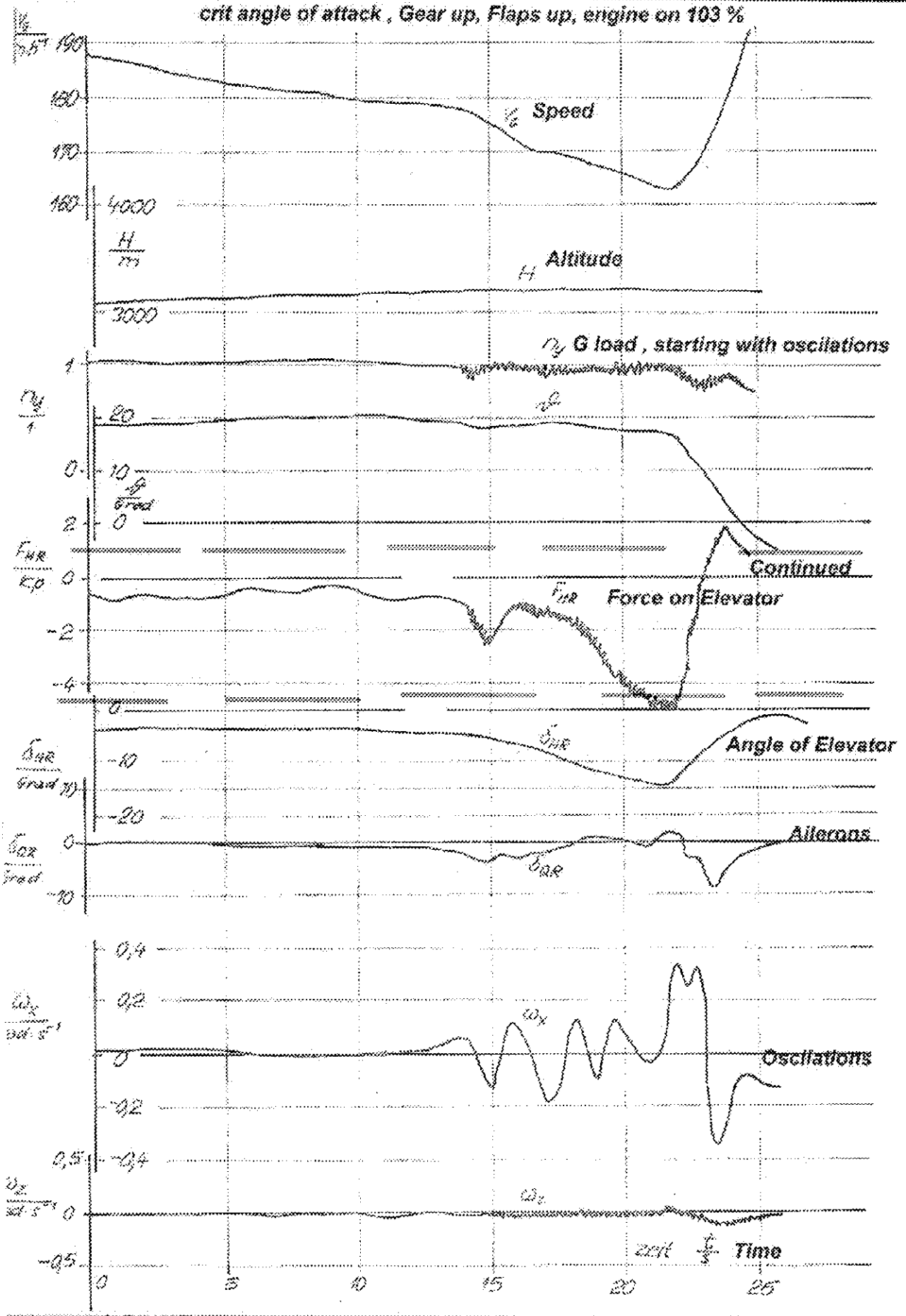
Longitudinal Stability, long periodical longitudinal movement





Steuerbarkeit bei kritischem Anstellwinkel, Fahrwerk und Landeklappen eingefahren, Normleistung des Triebwerkes

T 107



Annex 1

L 39 C AIRCRAFT WEIGHING FORM

Side A

AIRCRAFT WEIGHING PROCEDURE

Preparation for Weight and Balance

1. Check the integrity of the weighed aircraft.
2. Remove excessive dirt, grease, moisture and foreign objects from aircraft prior to weighing.
3. Replenish the engine and APU oil tanks to full capacity (19.8 Lb).
4. Release fluid from the hydraulic accumulators into the hydraulic reservoar.
5. Measure the nitrogen pressure in the hydraulic accumulators using assembly jig, respectively replenish the nitrogen in the hydraulic accumulators to a pressure of 725 Psi.
6. Replenish the air cylinder to a pressure of 2.175 Psi. The pressure verify on manometer situated on left hand flank skin of nose fuselage.
7. Replenish the hydraulic accumulators with a fluid to a pressure of 2.175 Psi.
8. Verify the pressure in six oxygen bottles, respectively replenish oxygen to a pressure of 2.175 Psi. The IK 52 pressure indicators are on instrument panels.
9. Defuel aircraft. Then shutoff firewall shutoff valve and open the fuselage and the wingtip tanks drain ports and allow remaining fuel in tanks and fuel accumulator to drain.
10. Retract flaps to full retracted position and position all control surfaces to neutral.
11. Close canopy.
12. Remove covers from air inlets, outlet nozzle and the other covers (besides cover of RIO-3 ice detektor sensor).
13. Conduct weighing inside a closed hangar to prevent errors in scale readings that may be caused by wind.

Leveling and Weighing

For leveling and weighing procedure use the Aircraft Weighing Form (see Side B).

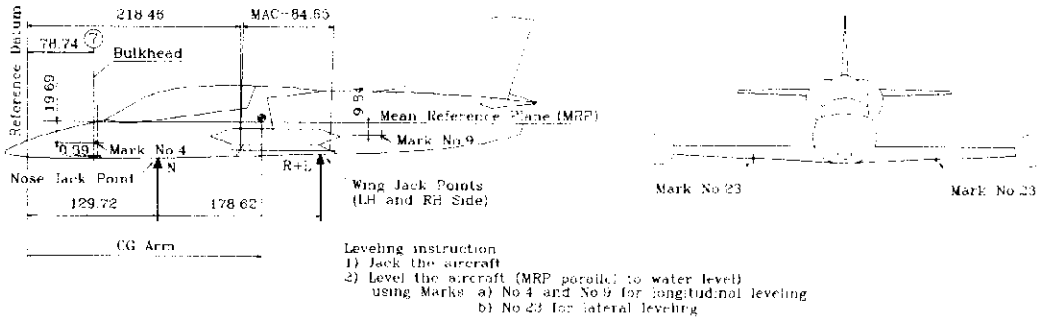
In order to determine basic empty weight and center of gravity (CG) proceed as follows :

1. Place the nose and two wing hydraulic jacks on scales, record the resulting weights into the Aircraft as Weighed Table (see Side B).
2. Jack aircraft and level its plane so that the Mean Reference Plane is horizontal (see Leveling Diagram in Side B).
3. Record the weight shown on each scale into the Aircraft as Weighed Table. Deduct the recorded jack weight from each reading.
4. Calculate the weight, CG position and moment/100 of the weighed aircraft (using formulae in point 1. on Side B) and record it into the Aircraft Basic Empty Weight and CG Position Table (see Side B).
5. Calculate the weight, CG position and moment/100 of basic empty aircraft (using formulae in points 2. and 3.on Side B) and record it into the Aircraft Basic Empty Weight and CG Position Table (see Side B).
6. **Caution**: Basic empty aircraft CG with landing gear extended must be within a range: 27.7 $\pm$ 0.5 % MAC.

Serial Number : _____ Date : _____ Name : _____

Signature : _____

Leveling Diagram



Scale Position	Symbol	Scale Reading (Lb)	Hydraulic Jacks Weight (Lb)	Net Weight (Lb)
Nose Jack Point	N			
LH Wing Jack Point	L			
RH Wing Jack Point	R			
Aircraft as Weighed (AW)	T			

NOTE

The aircraft must be weighed with the landing gear extended.

1.Determine CG arm and Moment/100 of the aircraft as weighed, using following formulae :

CG Arm = { 129.72 x N + [129.72 + 178.62] x [L + R] } / T [Inches aft of the reference datum]

or : CG Arm = {[CG arm (Inch) - 218.46] x 100 } / 84.65 [% of MAC]

Moment / 100 = { Weight (Lb) x CG Arm (Inch) } / 100 [Lb - In]

Where : MAC = The Mean Aerodynamic Chord of the Aircraft Wing

2. Determine Weight and Moment/100 of the Basic Empty Aircraft using following formulae:

Weight (BEA) = Weight (AW) + Weight (UF) [Lb]

Moment /100 (BEA) = Moment/100 (AV) + Moment/100 (UF) [Lb - In]

3. Determine CG Arm of the Basic Empty Aircraft using formula :

CG Arm (BEA) = [{ Moment /100 (BEA) } / Weight (BEA)] x 100 [Inches]

Note : For determination of CG Arm in % of MAC use formula mentioned in point 1.

Aircraft Basic Empty Weight and CG Position

Component	Weight (Lb)	CG Arm (Inches Aft of Datum)	Moment/ 100 (Lb - In)	CG Arm (% of MAC)
Aircraft as Weighed (AW)				
Unusable Fuel (UF)	14	251.85	35	———
Basic Empty Aircraft (BEA)				

Minutes Of The Meeting

Held

At AERO-Vodochody

on 2001 / 03 / 21

The meeting, held at the L-39 manufacturers facility, AERO Vodochody was scheduled to find some answers or inputs to proceed with the investigation of the :

Fatal accident
L-39 CT N602 MC
S/N 5234
24.01.01
Front Range Airport in Watkins Colorado

The following persons took part in the meeting :

for AERO-Vodochody

Mr. Josef	S v o b o d a	Sales Department
Mr. Zdenek	S t u c h l i k	Director Design / Engineering
Mr. Ladislav	S n y d r	Test pilot
Mr. Jiri	H r u s k a	Head of Value Engineering and Weight Analysis Dept.
Mrs Ivana	J a r o s i k o v a	Manager of Canopy Design Dept.

For the Ingenieurbüro für Luftfahrtgerät und Technolgie / Germany

Mr. Bernd	Rehn	President of aero-contact

1. Opening of the meeting by Mr. Svoboda

He introduced all the participants of the meeting and the current activities of AERO-Vodochody in the investigation of the accident.

- AERO Vodochody was informed by the Czech CAA about an accident notification of the FAA.
- AERO Vodochody offered the assistance for the crash investigation to the FAA in Washington. The offer was not answered by the FAA.
- AERO - Vodochody expressed their satisfaction to be involved in the investigation over aero-contact .

2. Mr. Rehn introduced the participants in the currently known things :

- Take off
- Flight path and maneuvers (as per radar tracking scheme)
- Statements of the witnesses
- Dimensions and partition of the crash site
- Special appearance of the canopy debris
- Distribution of airplane parts on the crash site
- Photos of the crash site and of the airplane parts
- Maintenance records, including weight and balance sheets

- Previous flights of the pilot
- Previous technical problems on the airplane (canopy drop, polishing, flight with not sealed canopy etc.)

Prior to the meeting the following questions were provided by aero-contact to AERO-Vodochody :

1. What's the correct procedure to do a weight and balance test on a fully equipped airplane?

2. Where is the correct Datum Line (like the point 0) for the weight and balance calculation? (Too many different procedures are circling in the USA now.)

3. How was the real condition of the airplane when the weight and balance was done in 1996 at AERO – Vodochody before delivery to Sundance? The weight and Balance was done on 02. May 1995 by Mr. M. Kerpl (Airplane No 5234).
   (Was the Russian Radio equipment installed in the plane at this time ???)
   The log book shows all the Radio equipment (R832, RKL-41, MRP-56 , RW-5 as installed, but no RSBN-5s.

4. What can cause short frequent longitudinal oscillations in flight? (maybe C.o.G. in far aft position ???)

5. Is there any information available , that some cleaning fluids can damage the crystalline structure of the Plexiglas?

6. Can any partially to the glass added heat cause some damages to the glass structure or produce some stress to the glass?

3. Discussion and answers to the questions according to Pt. 2

(1) The weight and balance method used by the factory is weighing the airplane on the jacks. After Mr. Hruska's explanation weighing an airplane on the wheels is also possible and only depends on using the right distances (arm) but weighing an airplane on the wheels is more difficult because of a possible movement of the wheels on the scales. Approx. 22 mm movement is later after the calculation approx. 1 % movement of MAC.

A factory weight and balance sheet, including instructions how to do the weight and balance calculation is attached to this report and will be also presented in the internet by aero-contact under www.aero-contact.com **(Annex 1)**

(2) The exact and only valid datum line is 250 mm behind the nose and/or 2000 mm in front of the bulkhead No 7 as per attached drawing. **(Annex 2)**

(3) The real condition of the airplane (installed radio equipment) at the time of weighing at the AERO Vodochody facility (02.05.96) is shown in the report of Mr. Hruska .
Mr. Hruska expressed that during the weight and balance procedure he strictly recommended to the representative of the buyer to do a weight and balance calculation again after modification of the airplane.

(4) Mr. Stuchlik, Mr. Snydr and Mr. Hruska stated that the found CG after the last W&B protocol of TURBO Jets seems to be far aft. However with the loss of the canopy glass, the cg moved again backwards but after the experience and earlier performed flight tests at AERO Vodochody it was clearly stated, that with this given cg each normal qualified pilot is able to fly the airplane safe and straight by using the trim.
Mr. Snydr flew a L-39 during the James Bond Movie ("Tomorrow never dies") without rear canopy and without rear ejection seat. No aerodynamically problems!

Mr. Hruska re-calculated the cg for the flight on January 24th, 2001 by using the main datas taken from the TURBO JET data sheet. Using the right datum line, he found the cg at 34,98 % MAC (TURBO JET at 34,42 % MAC). Calculating 2 pilots and filled main fuel tanks, the result was finally at 29,58 % MAC. This cg was tested many times at AERO Vodochody without any problems. **(Annex 3)**

However, a few unknown things are still there :

What kind of weight reduction happened to the airplane too after changing the Radio / Nav Equipment e.g. :

- pulling not used cables out of the nose and front part of the airframe ?
- removing original parachutes from the plane ?
- removing the 2 survival packages from the seat (ea. 10 kg) ?

(5) The front and rear canopy glasses were exchanged for brand new glasses at the factory directly before the airplane delivery from AERO Vodochody to Sundance.
The glass material was imported from UK.

Cleaning the canopy should be carried out only with linen or soft cotton material. For polishing the canopy it is necessary to use the special paste VIAM 2 together with absorbent cotton.
For normal cleaning use water and soap only. No chemicals or other cleaning agents are recommended. The influence of paint stripper or other chemicals is highly possible but needs to be tested in any special case.

It is strictly forbidden to expose the glass to temperatures above 50 °C or 122°F. While polishing the glass it is important that the area around the damage must be polished as well in a bigger area. It is not allowed to polish only a small spot or use high speed machinery . That would cause thermal stress in the glass structure.

An instruction for the organic glass maintenance and inspection is added in **Annex 4** and will posted on the web site for L-39 operators as a recommendation.

(6) Yes, partially added temperature is dangerous for the glass. Polishing the canopy frame can transfer heat to the glass. It depends on the duration and intensity of the work..

Mrs. Jarosikova explained that she has never seen such an untypical disintegration of a canopy glass. (see for question and requests)

4. Summary of the discussion , theories and statements

Mr. Snydr and Mr. Stuchlik stated that the loss of a canopy normally will not disturb a safe flight and will not prevent a safe landing. The loss of the canopy glass, which happens possibly unexpected to the passenger, can cause some reactions by the passenger, which could lead the passenger to take the control over the airplane or to affect the airplane control partially.

Mr. Snydr stated that after the airspeed which is indicated on the Radar Chart (159 - 209 kts) , the airplane is normally full controllable . There was not, at any time, an airspeed near to the airplane stall speed.

Mr. Snydr posted a theory No 1, that the pilot possibly had a black out during the sharp left turn for a few seconds or longer and that the passenger took over the control (may explain the up and down flight). The sharp left turn with the indicated airspeed of 173 kts could cause a g -load from 3 to 3,5 g . Reason for the black out of the pilot could be his lack of rest.

Mr. Snydr posted a theory No. 2 , that the pilot intentionally did a dive after the sharp left turn (for what reason ever.. in direction on to the road ??) and the passenger in the back seat, just recovering from the g-load (that maybe was a new experience for him), realized that the airplane is going down and touched (maybe panic) the controls, pulling the stick.

(so that the reported airplane "up and down" is a result of the control inputs from both cockpits)

Mr. Stuchlik expressed his astonishment for the canopy glass disintegration at this time of the flight , obviously after the plane climbed up from his first dive. He asked if there was any camera equipment or other movable equipment in the cockpit (fire extinguisher , crash ax) which could be used by a passenger in panic to brake the canopy glass from the inside.

(All participants of the meeting were wondering if a journalist in the back seat would not have a camera ...)

Mr. Hruska and Mr Snydr stated that the actually cg is aft, but will allow it to a normal pilot, using all the available equipment and following the FOM , to fly the airplane.

The following questions were asked :

Were camera equipment or other hard items on board ?

Were the parachute buckles latched safely and was the passenger really fastened by the parachute belt ?

What kind of parachute was installed, was the parachute buckle able (if not closed) to reach and hit the canopy glass under "-" g load ?

Are there any indications of injuries on the passengers hands (if still available) like broken fingers or bones in the hand, which can be an identification that he broke the canopy in panic from the inside by hand ?

Any indication of an black out ?

Was a blood test carried out on the both victims? Are there indications of adrenaline or other chemical abnormalities ? There are experiences at the Czech Republic, that with a blood test it can be verified if one of the guys has realized the coming end (just 5-8 seconds) before the impact. Is there any information available ?

Any indication of an intentional dive maneuver (surprising for the passenger) which could have lead to "fighting" for the control between pilot and passenger ?

AERO Vodochody asked for more canopy glass parts from the front and rear canopy for more investigations (possibly with the canopy glass manufacturer in UK) . Reason is that both canopies were replaced at the same time and only the rear canopy shows the small pieces.

If you have questions or comments, please do not hesitate to contact us at any time.
Any available information about the accident are welcome as a feed back for AERO-Vodochody.

Best regards

[redacted]

Dip.-Ing. Bernd Rehn

ANNEX 3

Centre of gravity – flying configuration in flight January 24, 2001

Aircraft No 5254

1 BASIC EMPTY AIRCRAFT – Turbo Jet Inc – 17.10.2000 – weighing

Mass = 7349 Lb = 3333,5 kg = (m)

(x_T) = CG = 248,07 inch = 6,301 m = 34,98 % MAC

Moment = (M) = 1823066,43 Lbinch = 21004,4 kg m

1 Basic Empty Aircraft	m = 3333,5 kg	x_T = 6,301 m	M = 21004,4 kg m
2 Front pilot	m = 80 kg	x_T = 3,075 m	M = 246 kg m
3 Rear pilot	m = 80 kg	x_T = 4,576 m	M = 366,1 kg m
4 Fuel in fuselage tanks	m = 840 kg	x_T = 6,174 m	M = 5186,2 kg m
Ramp mass characteristics	Σ m = 4333,5 kg	x_T = 6,185 m = = 29,58 % MAC	Σ M = 26802,7 kg m

This CG was tested in Aero Vodochody without any problems in control.

Mr. Ilavsko, Aero Vodochody
21.3 2001

The aircraft No. 5234 was weighed in Aero Vodochody 2.5.1996 without this systems:

- navigation system RSBN-5S
- command control system SDU-L39
- board transponder SRO-2
- crash recorder SARP-12 GM
- weapon sight system ASP-3NM/U-39
- camera gun FKP-2-2
- rocket EKSR-46 with control

For this configuration was CG: 27,8% MAC

The aircraft was weighed with this radio equipment systems:

- radio station R 832M
- board phone SPU-2
- radio altimeter RV-5M
- radio compass RKL-41
- marker MRP-56

During disassemble this systems in USA was necessary install ballast 21kg = 46 Lb between bulkhead No 1 and 2 !

Jiří Hruška
Weight Analysis Department
AERO Vodochody, Ltd

L 39 C AIRCRAFT

Aircraft Serial Number : 52 34

Date : 2.5.1996

Name : H. Kopl

Signature : [redacted]

Aircraft Basic Empty Weight and CG Position

Component	Weight (Lb)	CG Arm (Inches Aft of Datum)	Moment/100 (Lb - In)	CG Arm (% of MAC)
Aircraft as Weighed	7,348	242.00	17,782.16	27.8
Unusable Fuel	14	251,85	35	------
Basic Empty Aircraft	7,362	242.00	17,817.16	27.8

NOTES

1. The weighed aircraft includes the following components :
   - ballast (between bulkhead No. 1 and No. 2) - 45.2 Lb = 20,5 kg
   - two survival kits - 20.4 Lb each
   - pyro-cartridges and flares
   - oxygen - at pressure 2,175 Psi and weight 6.8 Lb
   - oil in engine and in APU - 19.8 Pounds
   - hydraulic fluid at pressure 2175 Psi and weight 41.2 Lb
   - undrainable fuel - 2.0 Lb.

2. The data are valid for the aircraft with landing gear extended and flaps retracted.

THIS BASIC EMPTY WEIGHT AND CG ARE VALID FOR THE AIRCRAFT AS DELIVERED BY THE MANUFACTURER.

WEIGHT AND BALANCE DATA FORM

Table T2

Weights and coordinates of variable loads for A/C C.G. position calculation

Nomenclature	Pcs	Weight m_i		C.G. position X_{Ti}	
		(kg)	(lb)	(m)	(inch)
Empty A/C (U/C up)	1	3 465	7 649	6,152	242,20
Front pilot	1	67	148	3,075	121,06
Front pilot	1	108	238	3,075	121,06
Rear pilot	1	67	148	4,576	180,16
Rear pilot	1	108	238	4,576	180,16
Fuel in fuselage tanks	1	840	1 852	6,174	243,07
Fuel in wing-tip tanks	1	156	344	6,137	241,61
Signalled fuel	1	150	331	6,140	241,73

Basic plane: X_T = 2 m (78,74 inch) in front of 7th bulkhead.

CG flying envelope : 17-27 % MAC

WEIGHT AND BALANCE
L-39C ALBATROSS

08-Oct-99

L-39C **NX602MC**
SERIAL # 135234

THIS AIRCRAFT WAS WEIGHED WITH FULL FUSELAGE FUEL, FULL OIL, AND FULL HYDRAULIC RESERVOIR. THE AIRCRAFT HAD BEEN STRIPPIED OF FOREIGN AVIONICS AND ASSOCIATED HARNESSES. AN AMERICAN RADIO PACKAGE HAD BEEN INSTALLED. THE ORIGINAL BATTERY HAD BEEN REPLACED WITH AN AMERICAN BATTERY. THE ORIGINAL PARACHUTES HAVE BEEN REPLACED BY AMERICAN PARACHUTES WITH MODIFIED HARNESSES. THE PARACHUTES WERE INSTALLED IN THE SEATS AT THE TIME OF WEIGHING AS THEY ARE AN INTEGRAL PART OF THE SEAT BELT SYSTEM.
SOLO FROM FRONT SEAT ONLY
CG WILL MOVE FORWARD .4" WHEN LANDING GEAR IS RETRACTED.

DATUM: 78.74" FORWARD OF NO.7 BULKHEAD

CENTER OF CRAVITY LIMITS	20% MAC	235.39
	27% MAC	241.31
MAXIMUM TAKE-OFF WEIGHT	10596 POUNDS	

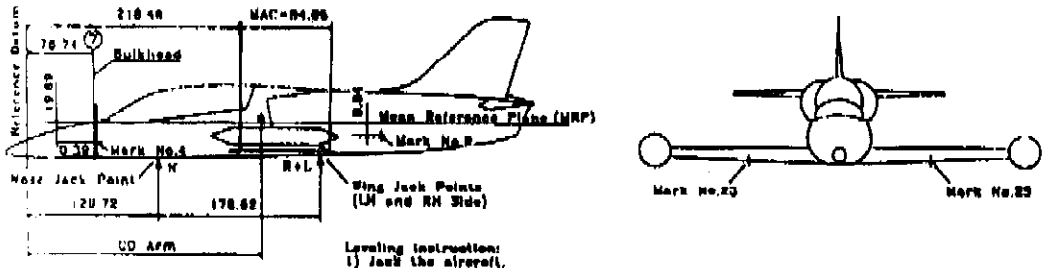
	WEIGHT	ARM	MOMENT
LEFT MAIN	4250	261.0	1109250.0
RIGHT MAIN	4204	261.0	1097244.0
NOSE	785	85.3	66921.25
TOTAL	9239	246.1	2273415.3
BALLAST	200	56	11200
TOTAL	9439	242.0	2284615.3
REMOVE FUSELAGE FUEL	-1945	242.82	-472284.90
TOTAL	7494	**241.838**	1812330.4

EWCG=241.837 or 27.6% MAC

Serial Number : 5234 Date : 10-17-00 Name : Turbo Jet, Inc.

Signature [redacted]

Leveling Diagram



Leveling instructions:
1) Install the aircraft.
2) Level the aircraft (MRP parallel to water level) using Marks: a) No.4 and No.9 for longitudinal leveling.
b) No.23 for lateral leveling.

Scale Position	Symbol	Scale Reading (Lb)	Hydraulic Jacks Weight (Lb)	Net Weight (Lb)
Nose Jack Point	N	2475		2475
LH Wing Jack Point	L	2380		2380
RH Wing Jack Point	R	2480		2480
Aircraft as Weighed (AW)	T	7335		7335

NOTE

The aircraft must be weighed with the landing gear extended.

1. Determine CG arm and Moment/100 of the aircraft as weighed, using following formulae :
   CG Arm = (129.72 x N + [129.72 + 178.62] x [L + R]) / T [Inches aft of the reference datum]
   or CG Arm = {[CG arm (Inch) - 218.46] x 100) / 84.65 [% of MAC]
   Moment / 100 = (Weight (Lb) x CG Arm (Inch)) / 100 [Lb - In]
   Where : MAC = The Mean Aerodynamic Chord of the Aircraft Wing

2. Determine Weight and Moment/100 of the Basic Empty Aircraft using following formulae:
   Weight (BEA) = Weight (AV) + Weight (UF) [Lb]
   Moment /100 (BEA) = Moment/100 (AV) + Moment/100 (UF) [Lb - In]

3. Determine CG Arm of the Basic Empty Aircraft using formula :
   CG Arm (BEA) = {(Moment /100 (BEA)) / Weight (BEA)] x 100 [Inches]
   Note : For determination of CG Arm in % of MAC use formula mentioned in point 1.

Aircraft Basic Empty Weight and CG Position

Component	Weight (Lb)	CG Arm (Inches Aft of Datum)	Moment/100 (Lb - In)	CG Arm (% of MAC)
Aircraft as Weighed (AW)	7335	248.06	1819589.4	34.97
Unusable Fuel (UF)	14	251.85	35	-----
Basic Empty Aircraft (BEA)	7349	247.60	1819624.4	34.42

NOTE : IT IS THE RESPONSIBILITY OF THE AIRCRAFT OPERATOR AND THE PILOT TO ENSURE AIRCRAFT PROPER LOADING. THE BASIC EMPTY WEIGHT AND CG POSITION ARE NOTED ON THIS FORM. REFERENCE AND COMPUTE WEIGHT AND BALANCE LOADING FORM IN THIS FLIGHT MANUAL. NOSE BAGGAGE AND OR BALLAST MAY BE REQUIRED.

Dear Rehn,

11.5.2001

I send you my calculations as you want:

Basic configuration of the aircraft is founded on information from weighing of aircraft - serial number 5234 on 17 of November, 2000.

Basic Empty Aircraft Weight:

Mass: m_0 = 7349 Lbs = 3333,5 kg

Center of gravity: x_T = 34,9 % MAC = 6,299 m !

CG for empty aircraft L 39C have to be: 27,7 ± 0,5 % of MAC !

Mass moment $M = m_0 . x_T$ (kgm)

Ramp configuration, two standard pilots, fuel in fuselage tanks:

Empty aircraft:	m_0 = 3333,5 kg	x_T = 6,299 m	M = 20997,7 kgm
Front standard pilot:	m = 80 kg	x_T = 3,075 m	M = 246 kgm
Rear standard pilot:	m = 80 kg	x_T = 4,576 m	M = 366,1 kgm
Fuel in fuselage tanks:	m = 840 kg	x_T = 6,427 m	M = 5398,7 kgm
Total ramp mass:	**m = 4333,5 kg**	**x_T = 6,232 m=31,79%MAC**	**M = 27008,5 kgm**

During take-off the aircraft was the CG position on 31,79 % MAC.

CG operational locations for all aircraft configuration have to be in a range : 20 – 27 % of MAC !"

Now different variants as you want:

No1: Two pilots, without rear canopy glass:

Total ramp mass:	m = 4333,5 kg	x_T = 6,232 m	M = 27008,5 kgm
Minus rear canopy glass:	- m = 16,4 kg	x_T = 4,702 m	- M = 77,1 kgm
Total	m = 4317,1 kg	x_T=6,238 m=32,06 % of MAC	M=26931,4 kgm

No2: Two pilots, without the entire rear canopy:

Total ramp mass:	m = 4333,5 kg	x_T = 6,232 m	M = 27008,5 kgm
Minus entire rear canopy:	- m = 33,6 kg	x_T = 4,701 m	- M = 158,0 kgm
Total	m = 4299,9 kg	x_T=6,244 m=32,35 % of MAC	M=26850,6 kgm

No3: One pilot,without the entire rear canopy:

Total ramp mass:	m = 4333,5 kg	x_T = 6,232 m	M = 27008,5 kgm
Minus rear pilot:	- m = 80 kg	x_T = 4,576 m	- M = 366,1 kgm
Minus entire rear canopy:	- m = 33,6 kg	x_T = 4,701 m	- M = 158,0 kgm
Total	m = 4219,9 kg	x_T=6,276 m=33,82 % of MAC	M=26484,4 kgm

No4: Plane with one pilot, ejected rear pilot (plus seat and rear canopy):

Configuration No3:	m = 4219,9 kg	x_T = 6,276 m	M = 26484,4 kgm
Minus rear seat:	- m = 81,5 kg	x_T = 4,813 m	- M = 392,3 kgm
	m = 4138,4 kg	x_T = 6,305 m = 35,16 % of MAC	M = 26092,1 kgm

I wish you and your american colleagues clear thinking during solution this case.

Yours sincerely,

Jiří Hruška

Attn: Jim Stuhseaker (NTSB Mishap Investigator)

SUBJ.: Life Sciences Equipment Determinations, L-39CT N602MC, DEN01FA044

1. The Life Sciences Equipment Laboratory (LSEL) has now completed an evaluation of the mishap exhibits received at Brooks AFB on 3, 22, 24 May and 14 June 01. The exhibits were primarily analyzed for: potential cause of rear canopy break-up prior to aircraft impact with the terrain.

2. All determinations made during the analyses conducted were based upon the submitted exhibits, which principally comprised of various canopy and wind-screen fragments as follows: 1 Right and 1 Left side section of front cockpit canopy frame, 1 Rear Bow section of front cockpit canopy frame, 1 large plexiglass section of front cockpit canopy frame; 1 Right and 1 Left side section of rear cockpit canopy frame, 1 Rear Bow fragment of rear cockpit canopy frame; 170 plexiglass fragments of rear cockpit canopy frame; 4 canopy locks of the rear cockpit, 3 sections of forward wind-screen, 2 canopy bow sections from non-identified cockpit, and 3 aircraft frame fragments.

3. Equipment observations:

   A. Rear Cockpit Canopy Plexiglass: All rear cockpit canopy fragments were visually inspected for indications of any potential blood spatter. The canopy sections that had residues similar in appearance to blood were tested using McPhails Blood Reagent. No positive indications for the presence of blood was found on any of the Rear Cockpit Canopy Fragments.

   B. Rear Cockpit Left Side Section Front Latch area: The damage to the exterior side of the canopy, which is adjacent to the front latch area, aligns well with the profile of the top of the canopy lock. A bolt adjacent to the damaged exterior metal was partially extracted, with the opposite interior side of the bolt sheared off. This damage indicates a forceful sideway motion to the right, as observed by a crewmember facing forward, of the canopy frame with respect to the canopy lock/frame of the aircraft. On the opposite interior side of the front latch, there is an impact mark on the metal structure, which aligns with the canopy lock, and is in-line with the previously noted damage on the exterior side of the canopy. The damage observed on both sides of the front latch is considered attributable to forceful contact with the canopy lock. On the latch itself there was a gouge in the metal located on the upper forward portion of the latch.

   C. Rear Cockpit Left Side Section Rear Latch area: The metal (on the exterior of the canopy) that was adjacent to the rear latch had a fragment sheared off, and subsequently embedded between the surrounding external metal and the canopy latch. The embedded metal fragment had damage on

its bottom side that was consistent with the profile of the top of the canopy lock. On the opposite interior side of the rear latch there is an impact mark to the metal that aligns with the canopy lock and is in-line with the damage on the exterior metal. It is considered that an upward directed force would be required to embed the metal fragment between the adjacent metal and the canopy latch. It is also considered that the force which caused this damage was most probably generated from the exterior canopy metal forcefully contacting the top of the canopy lock. The profile damage of the embedded metal fragment supports contact with the top of the canopy lock. Also, there is heavy metal impact damage on the opposite side of the rear latch, as was the case with the front latch. The damage observed on both sides of the rear latch is considered attributable to forceful contact with the canopy lock. On the latch itself there was a gouge in the metal located on the upper forward portion of the latch.

Conclusions:
The damage observed on the rear cockpit canopy structures indicate that the front and rear canopy locks were not properly secured to their respective latches at the time the damage occurred. It also indicates that the top of the canopy locks were in contact with canopy structures that were adjacent to both sides of the front and rear latches. It is considered improbable that the type of damage noted in this mishap was the result of a single motion such as aircraft impact with the terrain. Instead, it is considered much more likely that the damage observed was the result of multiple motions, such as flexing of the canopy frame while in-flight; resulting from rear canopy locks not being properly secured at some point during the flight prior to aircraft impact with the terrain.

4. Disposition of Mishap Exhibits: The left side of the rear cockpit canopy and 8 pieces of canopy plexiglass will be shipped for further study to AFRL/VASD, 2210 8th Street, Room 218, WPAFB OH 45433-7532. The remainder of the exhibits will be sent to Beegles Aircraft Services, 711 Crosier Ave., Weld County Airport, Greeley, CO 80631.

5. If this Organization can provide any further assistance regarding the exhibit studies completed to date please contact Mr. G. Shidler at Ph:210-536-6789 or DSN: 240-6789.

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

27 February, 2002

MEMORANDUM FOR JAMES F.STRUHSAKER
NTSB
4760 Oakland Street
Denver, CO 80239

FROM: Mike Gran, Air Force Research Laboratory

SUBJECT: Aero Vodochody L-39C accident on 24 January 2001

1. The Air Force Research Laboratory, at the request of the National Transportation Safety Board, analyzed the provided pieces of the canopy from the L-39C aircraft. The pieces included the transparency and frame assembly of the canopy system. I am an Aerospace Engineer in the Air Vehicles Directorate of the Laboratory. I have worked on every aircraft canopy system that the Air Force currently has in their inventory. I have also worked on many civilian aircraft over my seventeen years of work for the Air Force Research Laboratory. Samples from the aircraft were sent for analysis to Marilyn Unroe of the Materials and Manufacturing Directorate in the Air Force Research Laboratory. Marilyn and I work on many thermoplastic material problems. Her findings are attached in a separate letter.
2. Aerospace Composite Technologies/GKN located in Luton, England manufactured the L-39C canopy transparency. The transparency is 3/8 inch thick acrylic (PMMA). I have been to the manufacturing plant of ACT/GKN. They are the major manufacturer of all transparencies in Europe. This includes all fighters, civilian aircraft and some helicopters. They are very capable technical experts with a modern manufacturing facility. Their main product is acrylic windshields and canopies.
3. The canopy transparency failed on the L-39C because of acrylic embrittlement. The acrylic does have a low molecular weight, but the catastrophic failure occurred because of chemical contamination to the acrylic substrate. This could be simply aggressive cleaning fluids getting into the canopy frame channel and staying there during thermal and structural loading. The design of the canopy system comes from the 1950s, even though the first flight of the L-39 was in 1968. It was not uncommon for subsystems to migrate through the years when there were no apparent problems. This is a bad design for a thermoplastic material. There is no where for the fluid to go in this channel, it would build up and soak the acrylic substrate. Care must be taken when dealing with acrylic and other thermoplastic materials. Certain chemicals, adhesives and vapors will fracture acrylic under stress. This condition increases with the addition of

thermal loading. It is very difficult to know what chemical contaminated the acrylic because no residuals are left on the transparency. The Air Force has lost transparencies in flight because of chemical contamination of the thermoplastic material.

Atch:
AFRL/MLBP Technical Inputs

MIKE GRAN
Aerospace Engineer
Air Vehicles Directorate
Air Force Research Laboratory

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

7 December 2001

MEMORANDUM FOR AFRL/VASD

FROM: AFRL/MLBP

SUBJECT: MLBP Technical Inputs to NTSB Accident Investigation of Canopy Transparency of Atlas Air L-39 Aircraft

1. The following comments are the results of our internal analysis of specimens provided to the Polymer Branch, Nonmetallic Materials Division, Materials and Manufacturing Directorate, Air Force Research Laboratory. We were requested on 18 October 2001 by personnel of AFRL/VASD to participate and contribute a portion of the technical comments relative to the quality of the 3/8 inch thick poly(methylmethacrylate) (PMMA) substrate used for the transparency of the canopy subsystem of the subject aircraft. We limited our approach at this time to nondestructive types of analyses since we were unsure of the current need for the return of all evidence to the investigation board.

2. Our findings are summarized below:

A. Fourier-Transform Infrared (FTIR) spectroscopic analysis upon a 3/8-inch substrate sample from the visual area of the canopy indicated no residual methacrylic acid or methyl methacrylate monomer present in the polymer (Aldrich Encyclopedia of FTIR Spectra, Vol. III, pp. 292, 379). Presence of even minute portions of acid, monomer or even polymerization catalysts in PMMA can cause rapid polymerization of the residue near 100 degrees C (Polymeric Materials Encyclopedia, Vol. 8; J. C. Salamone, ed.-in-chief; Boca Raton, FL: CRC Press; pp. 6385-6391, 1996), so the presence of methacrylic acid or methyl methacrylate was a factor to examine concerning the catastrophic nature of the canopy failure. The PMMA does appear to be of relatively low molecular weight, though, and in the range of 30,000-150,000 Daltons when compared to known samples of low and high molecular weight cast samples of PMMA (Aldrich Encyclopedia of FTIR Spectra, Vol. III, pp.1584-1585). Evidence for the low molecular weight is the shift to longer wavelengths (higher frequencies) of some key carbon-carbon-oxygen and oxygen-carbon-carbon bond stretches in the polymer backbone. Thus it is possible that the mechanical strength of the PMMA is not at optimum levels for use as a window structure. Destructive mechanical testing would need to be performed to determine the transparency's mechanical properties in tension and compression.

B. Atomic Force Microscopy (AFM): Examination by AFM of the transparency edge (Figures 1-6) that rests within the sill plate indicates a large amount of micro and macrovoids in the brown surface edge, presumed to be an adhesive primer used to seal the transparency edge to the sill plate gaskets of the canopy. There are also macrobubbing artifacts on the brown sill edge surface as shown in Figures 4 and 5 of the attachment. A detailed image of a typical pore

(Figure 6) indicates a void structure of approximately 10 microns diameter and a depth greater than 3000 nanometers (3 microns). Pore depth determination was limited by the actual height (3 microns) of the shape of the gold probe used to scan the surface topography of the sample.

C. Optical Microscopy: We did not supply any photo coverage of this examination, but visual inspection under low power microscopy indicated a large amount of bubble voids inside the bulk PMMA substrate near the sill edge, far beyond the acceptable amount found in DOD MIL-P-20690, a military spec for optical grade stretched acrylic. It is yet undetermined if the void content is uniform throughout the entire substrate and is indicative of a manufacturing anomaly. MLBP is thus not able to assess the entire void content of the PMMA substrate due to limited samples of the transparency. However, further analysis by differential scanning calorimetry (DSC) to determine the glass transition of the substrate may provide insight into the manufacturing processes possibly at fault for the internal voids. One of the manufacturing processes that may have contributed to the voids is manufacture of the sheet acrylic by bulk casting between glass plates, an economical commercial fabrication process which requires high vacuum, versus melt-calendared sheet, a process employed for manufacture of high quality sheet acrylic product in more technically advanced countries worldwide. Another manufacturing process that can contribute to void production in the sheet material is the addition of nonvolatile solvents such as toluene to a viscous polymer to dilute the polymer to a suitable viscosity for the forming process. Upon vitrification, some solvent may be trapped in thicker portions of the polymer slab.

3. Further destructive testing by methods such as DSC, elemental analysis and mass spectroscopy can identify some of the essential information relative to any metallic impurities in the PMMA substrate, any residues of catalysts used in the manufacture of the polymer, and some indications of the manufacturing process for the PMMA. The value of mechanical testing would provide information on the overall mechanical performance of the transparency material. All of this testing provides more insight into the complete picture of the quality of the PMMA used in the Atlas Air L-39. The Polymer Branch would not conduct any of this work without further instruction to destroy a piece of the transparency by the lead organization of the investigation.

4. We gratefully acknowledge the assistance of Mr. Jacque Henes, University of Dayton Research Institute, Dayton, OH, for the bulk of the microscopy analyses and the digital photographs pertinent to this work. Mr. Shane Juhl, SOCHE student, Wright State University, Dayton, OH, also participated in the effort by assisting Mr. Henes with the operation of the atomic force microscope.

5. Further discussion of the data interpretation is available by contacting Marilyn R. Unroe, Research Chemist, AFRL/MLBP, DSN 785.9145, Commercial 937.255.9145.

[redacted]

MARILYN R. UNROE, Research Chemist
Nonmetallic Materials Division
Materials and Manufacturing Directorate

Optical Microscope Images

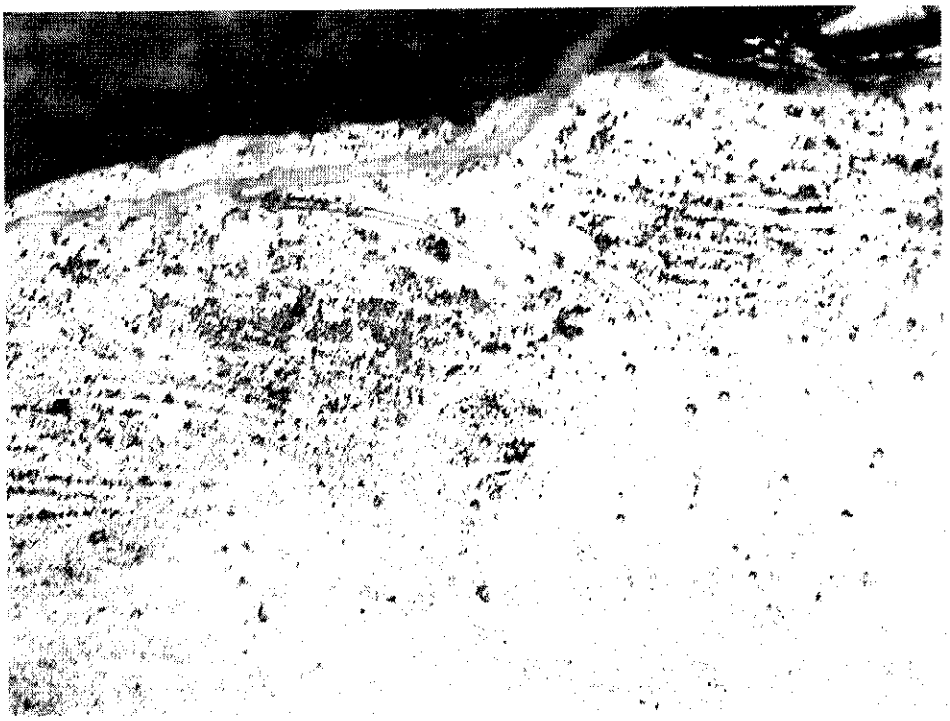


Figure 1: Middle of the sample along the canopy sill edge at 50x magnification.

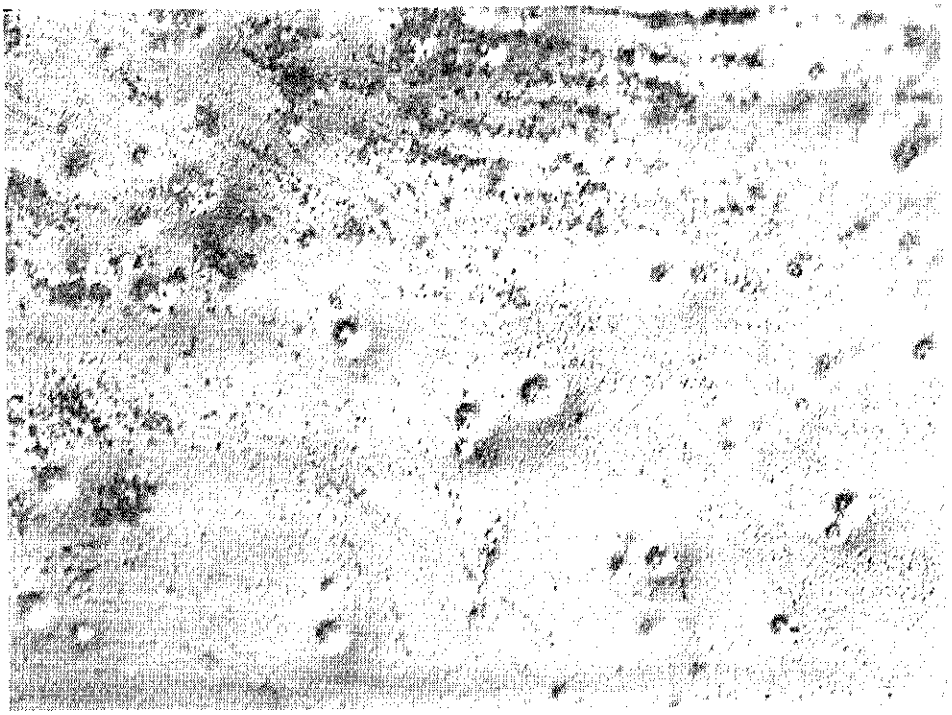


Figure 2: Middle of the sample along the canopy sill edge at 100x magnification.

Figure 3: Left edge of the sample on the canopy sill edge at 50x magnification.

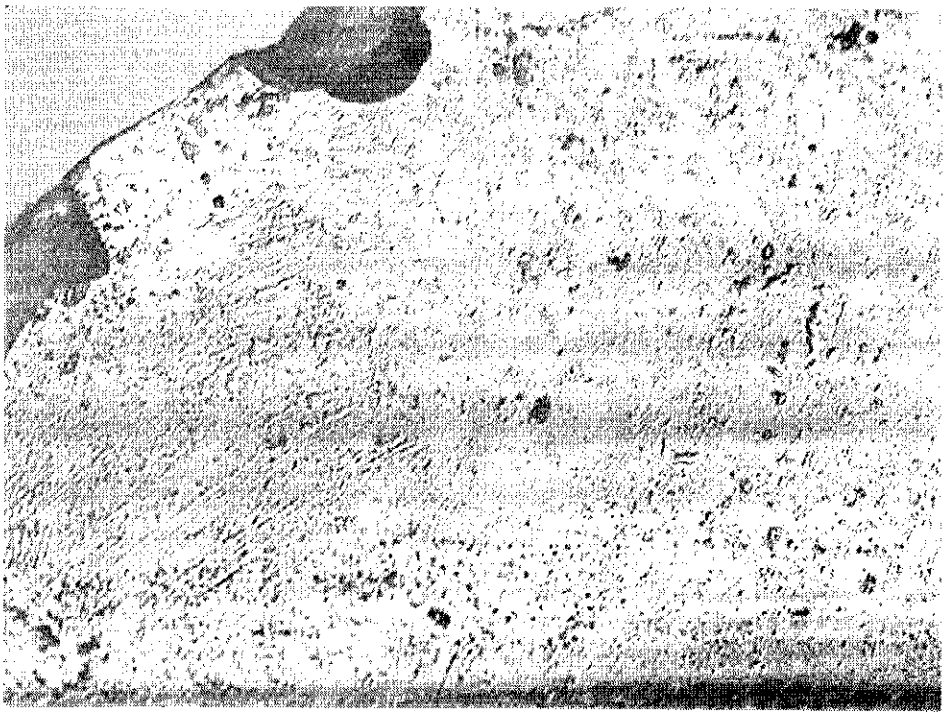


Figure 4: Left edge of the sample on the canopy sill edge at 100x magnification.

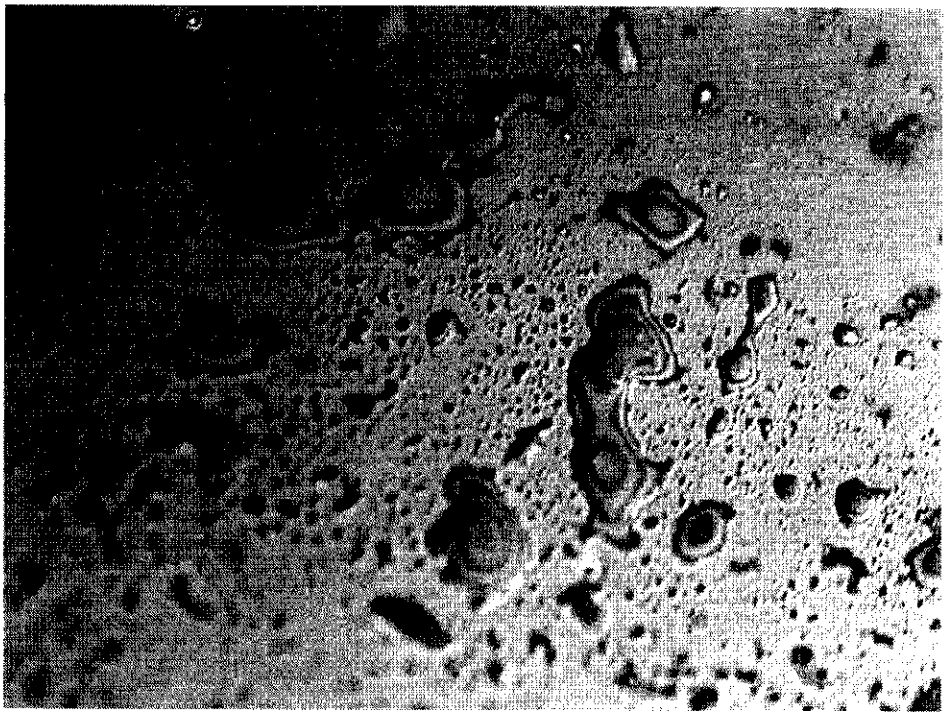


Figure 5: Left edge of the sample on the canopy sill edge at 500x magnification.

Atomic Force Microscope Image

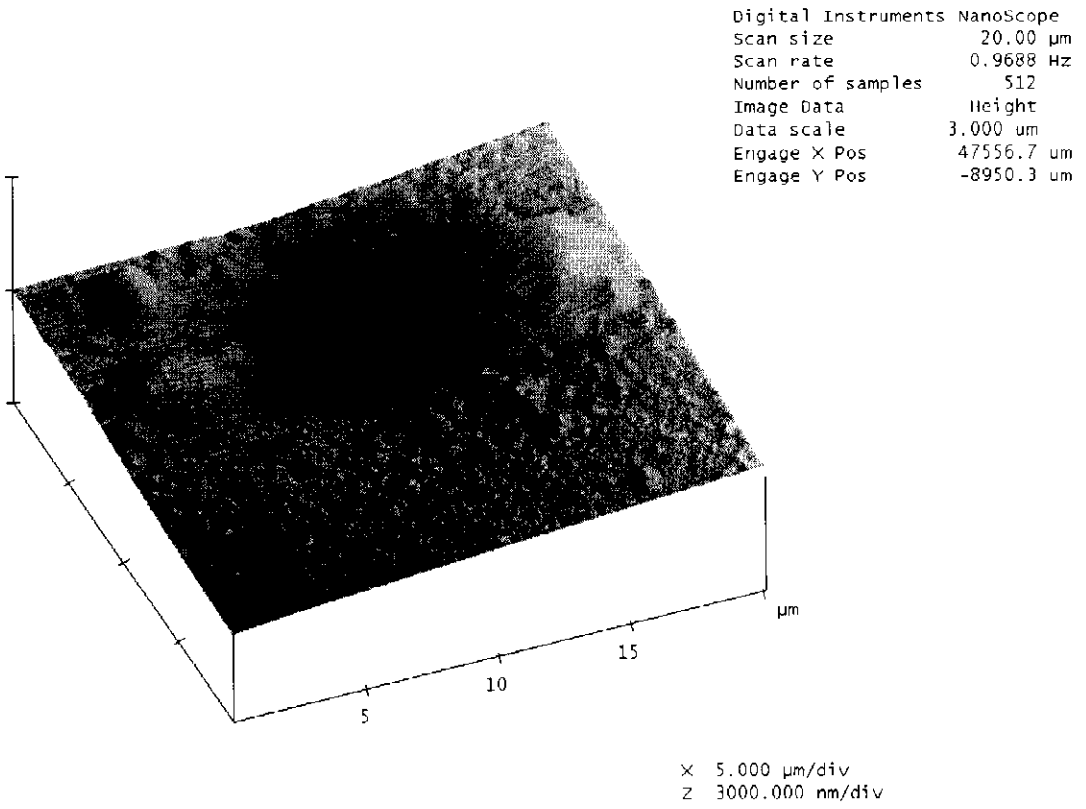


Figure 6: Image of scan over a pore in middle of sample on the canopy sill edge

Digital Image of Sample

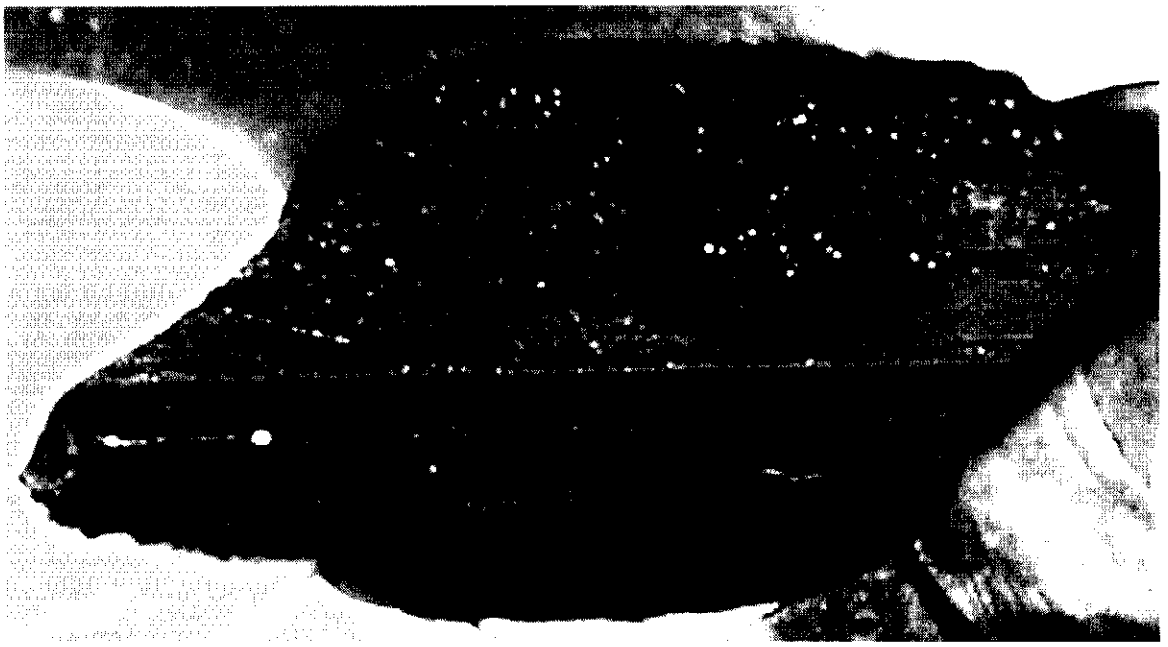


Figure 7: Nikon 990 digital image of mounted canopy sill edge sample used in Optical and Atomic Force microscopy.

ANNEX 4

5–53. ORGANIC GLASS INSPECTION.
See figure 5–14.

5–54. **Tools and Equipment.**

Tenfold magnifying glass
Steel rule, 300 mm long

NOTE

The rule shall have rounded corners.

5–55. **Materials.**

Clean, soft cotton or linen wiper

NOTE

The wiper shall be clean, washed, with no hard ingredients

It is prohibited to use woolen or silk wipers.
Absorbent cotton
Paste, Viam 2

5–56. **Manpower.**

One person required

5–57. PROCEDURE

a. Glass cleaning

(1) If the glass is dewed or covered with ice, dry it out with warm air flow

CAUTION

Air temperature shall not exceed 122 °F (+ 50 °C). Do not allow glass local warming-through.

(2) Wash the glass with a clean damp wiper (for requirements, see Materials).

(3) If there are any greasy stains, wipe them off with a dry wiper and then clean with a piece of absorbent cotton dipped in the Viam 2 paste. After cleaning the stains, remove completely all remaining paste.

(4) If the temperature is lower than 41 °F (+ 5 °C), dry out the glass with warm air flow.

CAUTION

Air temperature shall not exceed 122 °F (+ 50 °C). Do not allow glass local warming-through.

b. Inspect the glass condition at a properly illuminated place

(1) Inspect the glass from the outside, first in the middle, then thoroughly along the frame. When inspecting the glass, look for defects described in table 5–2 and determine the way of remedy, referring to table 5–3.

(2) Inspect the glass from the inside, first in the middle, then thoroughly along the frame and along the warm air inlets. When inspecting the glass, look for defects described in table 5–2 and determine the way of remedy, referring to table 5–3.

NOTE

Inspect the glass with eyes only. Use magnifying glass if necessary for closer specification of defects.

Table 5–2. Defect Specification

Defect	Defect Description
Crack	Partial or complete damage of glass compactness
Crumbling	Spot damage of glass surface in a form of flakes
Chip	Spot damage as a result of a mechanical stroke
Scratch	A hairline scratch of width not exceeding 0.005 mm and depth not measurable
Cut	A cut exceeding the parameters of a "scratch"

(table continued on next page)

Defect	Defect Description
Glass silvering	Micro-cracks 0.1 mm deep, showing silver luster in reflected light
Optical distortion	Looking through plexiglas damaged this way gives the shape and/or distance of the observed objects optically distorted

Table 5-3. Defect Remedy

Defect		Extent	Remedy
Loss of transparency		Any extent	Replace the defected assembly
Cracks		Any amount	Replace the defected assembly
Scratches		No limitation unless making the glass surface matte	Polish
		Making glass surface matte	Replace the defected assembly
Any type of defects distant less than 2 in (50 mm) from the frame		Chips, crumbling or glass silvering of any extent	Replacethe the defected assembly
Simultaneous appearance of defects		Total number of defects (sum of defects of all types) is more than 15. NOTE Do not include scratches	Replacethe the defected assembly
Cuts	Windshield cuts	Fewer than 3 cuts thinner than 0.019 in (0.5 mm) and shorter than 7.9 in (200 mm)	Polish
	Cuts on the forward canopy glass	10 or fewer cuts thinner than 0.019 in (0.5 mm) and shorter than 7.9 in (200 mm)	Polish
	Cuts on the aft canopy glass	10 or fewer cuts thinner than 0.012 in (0,3 mm) and shorter than 7.9 in (200 mm)	Polish
	Cuts (generally)	Greater extent than specified above	Replacethe the defected assembly
Chips	Windshield or forward canopy glass chips	A single defect smaller than 0.039 in (1 mm)	Polish
	Aft canopy glass chips	A single defect smaller than 0.027 in (0,7 mm)	Polish
	Windshield chips	4 or fewer defects smaller than 0.027 in (0,7 mm), distant more than 3.94 in (100 mm) from each other	Polish
	Forward canopy glass chips	10 or fewer defects smaller than 0.027 in (0, 7 mm), distant morethan 3.94 in (100 mm) from each other	Polish
	Aft canopy glass chips	10 or fewer defects smaller than 0.016 in (0,4 mm), distant more than 3.94 in (100 mm) from each other	Polish
	Chips generally	Greater extent than specified above	Replacethe the defected assembly

(table continued on next page)

Defect		Extent	Remedy
Crumbling	Windshield or forward canopy glass crumbling	5 or fewer defects smaller than 0.039 in (1 mm)	Polish
	Aft canopy glass crumbling	5 or fewer defects smaller than 0.027 in (0,7 mm)	Polish
	Crumbling generally	Greater extent than specified above	Replace the defected assembly
Centers of glass silvering		5 or fewer defects smaller than 0.197 in (5 mm)	Polish
		Greater extent than specified above	Replace the defected assembly

ATTN JIM FROM: Turbo Jet

NOTE

The airbrake can be controlled from the front cockpit ONLY when the rear switch is in the neutral position.

Indication is identical in both cockpits and consists of a green "AIRBRAKE OUT" light on the landing gear position indicator panel. On attaining the flight speed of M 0.78 ± 0.02, the airbrakes extend automatically and retracts when speed is reduced below this value.

RAM-AIR TURBINE

The ram-air turbine uses pressure from the main hydraulic system for extension and retraction and provides an alternate source of electric power in case the engine-driven main generator fails. The ram-air turbine extends automatically whenever the main voltage drops. The ram-air turbine is automatically retracted when main voltage is restored, when the nosewheel contacts the runway and during emergency ground retraction of the landing gear. In case of failure of the main hydraulic system, the ram-air turbine can be extended by means of the emergency lever located on the right console. Operation of the ram-air turbine is indicated by a combination of the "GENERATOR" and the "EMERG GEN" as follows:

1. "GENERATOR" light-OFF) idnicates RAT is retracted and
   "EMERG GEN" light-OFF) out of operation
2. "GENERATOR" light - FLASHING
   "EMERG GEN" light - OFF — indicates RAT is extended and in operation
3. "GENERATOR" light - FLASHING
   "EMERGE GEN" light -FLASHING — indicates RAT is either extended or retracted and out of operation

PNEUMATIC POWER SUPPLY SYSTEM /Figure 1 - 22/

Aircraft air system is used for filling the sealing hoses of the windshield and canopies of both the cockpits and for pre-

KP/CM² = 14.223 PSI

ssurizing the hydraulic tank. The air source for sealing hoses is an air bottle with volume of 2 litres and pressure of 15 MPa (150 kp/cm sq.). reduction valves in the front cockpit reduce gradually this pressure to value of 15/5 MPa; 5/0.11÷MPa (150/50 kp/cm sq. snf 50/1.1÷kp/cm sq.). 0.23

Sealing effect of the windishield and canopies is produced after previous closing and locking the cockpit locks by moving the lever controlling the pressurizing and air-conditioning systems forwards to central position. This can be executed from both the cockpits. 2.3

Reverse sequence is used for draining the air from sealing hoses.

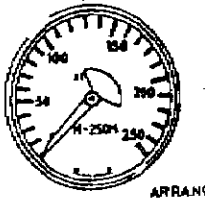
WARNING

When unlocking the locks without previous depressurizing (and/or during ejectioning), the air in sealing hoses becomes drained automatically. This way is not recommended since the canopies could jump out of their hinges.

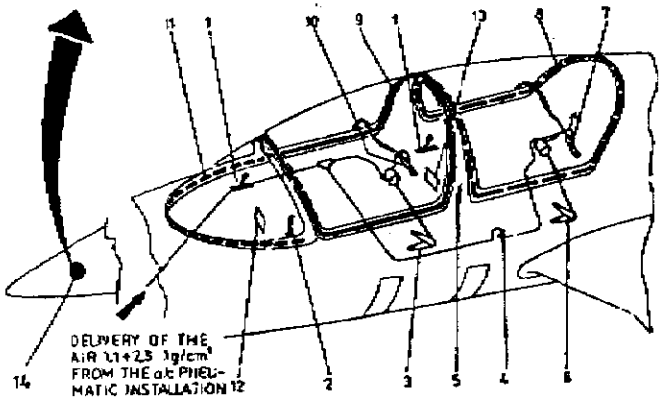
N.O.T.E

It is needed before engine test to move the lever of "PRESSURIZING and AIR DELIVERY" forwards to central position for pressurizing of the hydraulic tank.

AIR PRESSURE GAUGE



ARRANGEMENT OF THE PNEUMATIC SYSTEM



WARNING PANEL

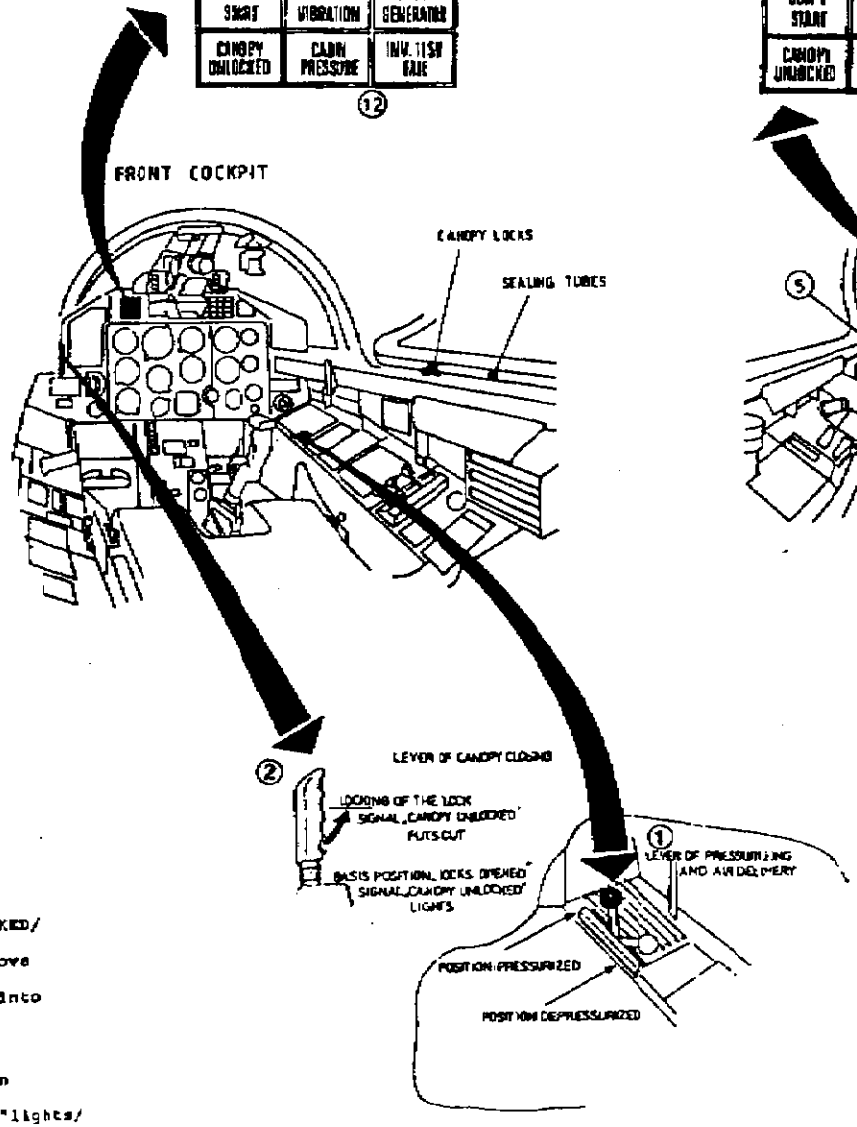
FIRE	DANGEROUS ALTITUDE	M MAX.
150 KG FUEL	HYD. SYST. FAIL	GENERATOR
DON'T START	ENGINE VIBRATION	EMERGENCY GENERATOR
CANOPY UNLOCKED	CABIN PRESSURE	INV. 115V FAIL

(12)

WARNING PANEL

FIRE	DANGEROUS ALTITUDE	M MAX.
150 KG FUEL	HYD. SYST. FAIL	GENERATOR
DON'T START	ENGINE VIBRATION	EMERGENCY GENERATOR
CANOPY UNLOCKED	CABIN PRESSURE	INV. 115V FAIL

(13)



LEGEND:

1.Lever of pressurizing and air delivery
2.Lever of canopy closing /front cockpit-inner/
3.Lever of canopy closing /front cockpit-outer/
4.PIPE LINE
5.Lever of canopy closing /rear cockpit-inner/
6.Lever of canopy closing /rear cockpit-outer/
7.Telescopic joint-rear
8.Sealing tube of the rear cockpit
9.Sealing tube of the front cockpit
10.Telescopic joint-front
11.Sealing tube of the tiltable windshield
12.Warning panel in the front cockpit
13.Warning panel in the rear cockpit
14.Air pressure gauge

COCKPIT PRESSURIZING /for the pilot in the front or rear cockpit/

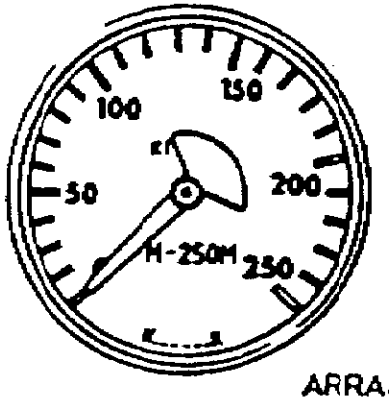
1.Close the canopy
2.Lock the locks of the canopy /signal CANOPY UNLOCKED/ puts out/
CAUTION: If the signal continues is needed to remove the failure on the canopy
3.Shift the lever of pressurizing and air delivery into position canopy sealing

COCKPIT DEPRESSURIZING

1.Shift the lever of pressurizing into rear position /pressure air from the sealing tubes vents/
2.Open the locks of canopy /signal "CANOPY UNLOCKED"lights/

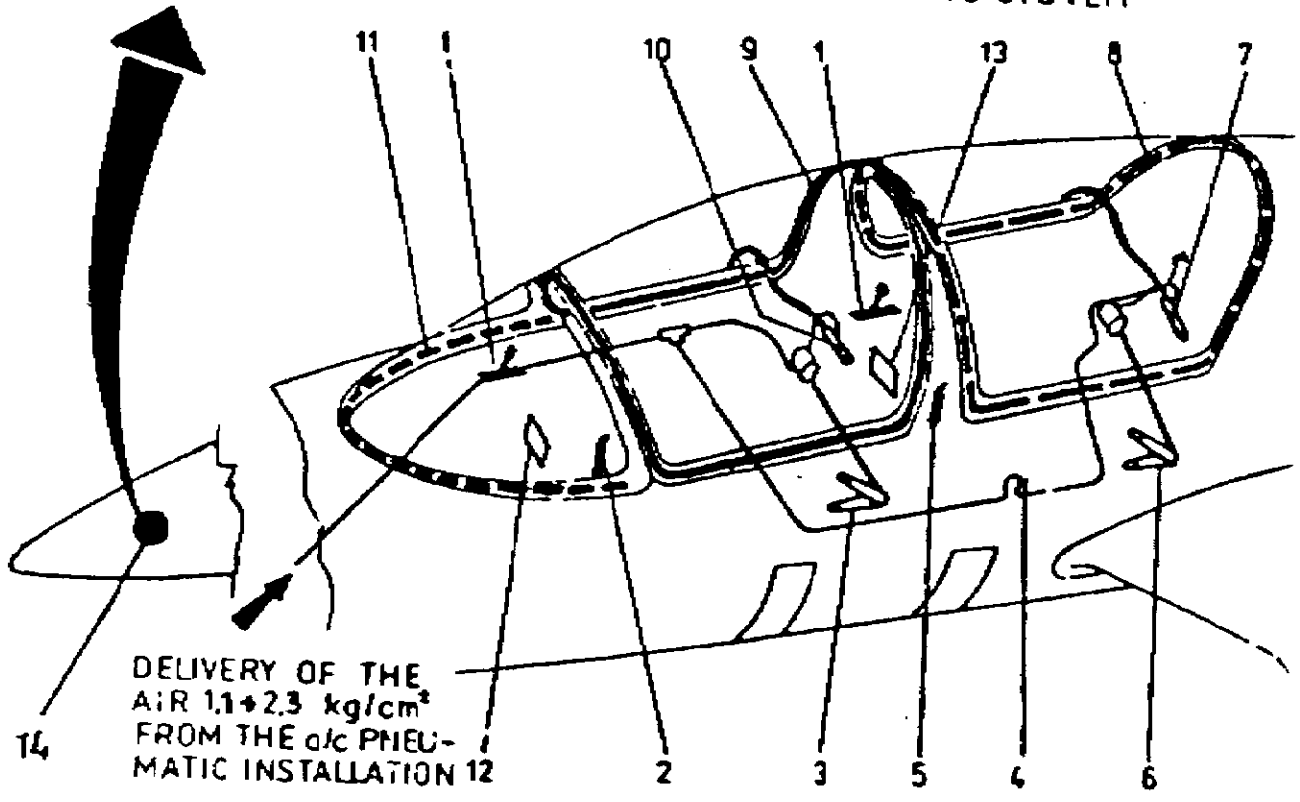
Figure 1 - 22

AIR PRESSURE GAUGE



(14)

ARRANGEMENT OF THE PNEUMATIC SYSTEM



Fig

LEGEND: