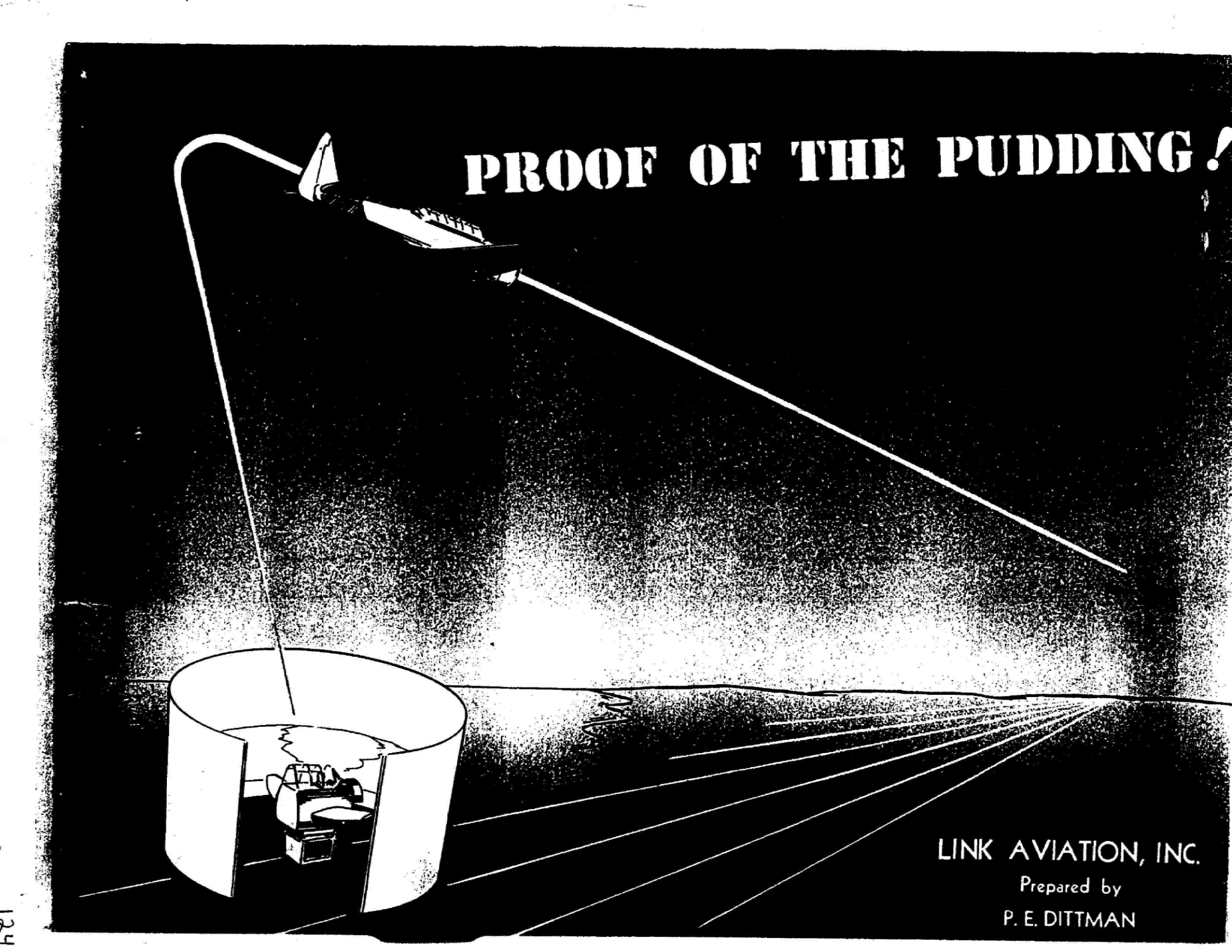
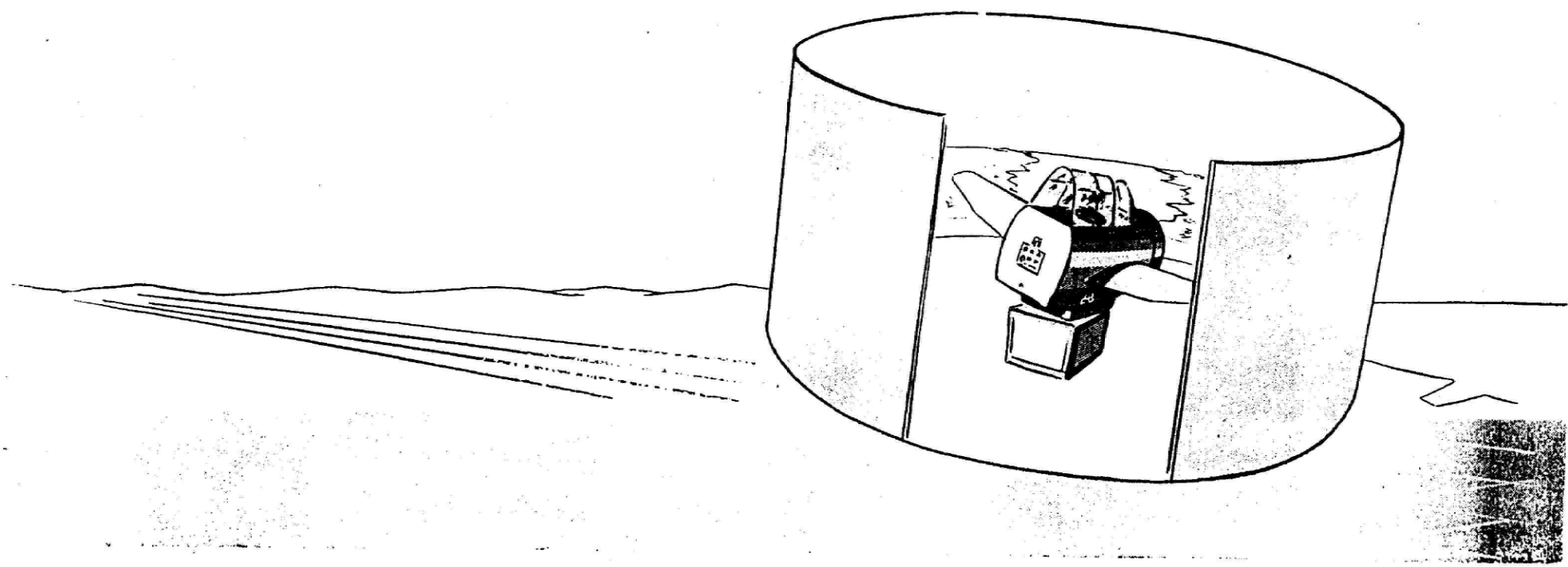

PROOF OF THE PUDDING!
LINK AVIATION, INC.
Prepared by
P. E. DITTMAN

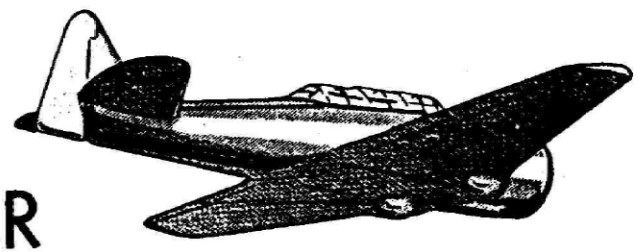


A REPORT ON

THE SCIENTIFIC EVALUATION

OF THE

LINK SNJ OPERATIONAL TRAINER



AS AN AID IN

CONTACT FLIGHT TRAINING

Conducted by

THE UNIVERSITY OF ILLINOIS

Department of Psychology

FOREWORD...

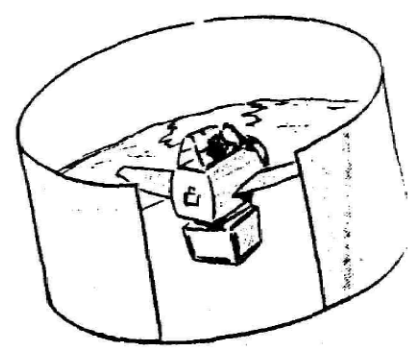
For a long time all those interested in flight training have agreed that the use of "synthetic flight" trainers has a certain qualitative value in teaching students to fly. The only lack of unanimity has been in the quantitative degree to which that value was effective.

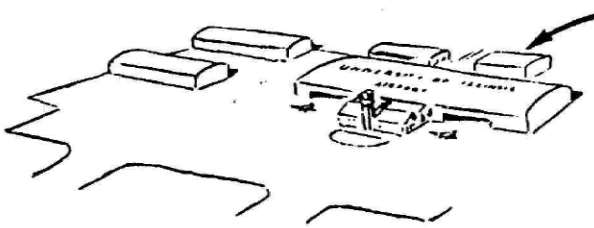
Now an evaluation concluded at the University of Illinois in mid-June, 1949, furnishes a definite, tangible figure of measurement and proof. The results forcibly substantiate previous surmise by demonstrating, in flat, cold figures, the effectiveness of a "synthetic flight" trainer in contact flight training.

This effectiveness is highlighted by the superior performance of students trained in the "synthetic flight" trainer, as compared to the performance of students trained in aircraft only, in achieving an identical standard of proficiency.

The trainer students' records showed that they:

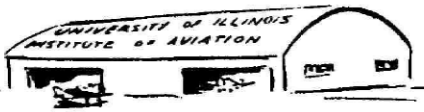
- Required 874 fewer trials --- a 62% saving
- Made 1511 less errors --- a 73% saving
- Took 43:36 less air hours --- a 62% saving - than the aircraft group.





This evaluation was conducted at the University of Illinois Institute of Aviation during 

1949, by  Dr. A. C. Williams, Jr., 

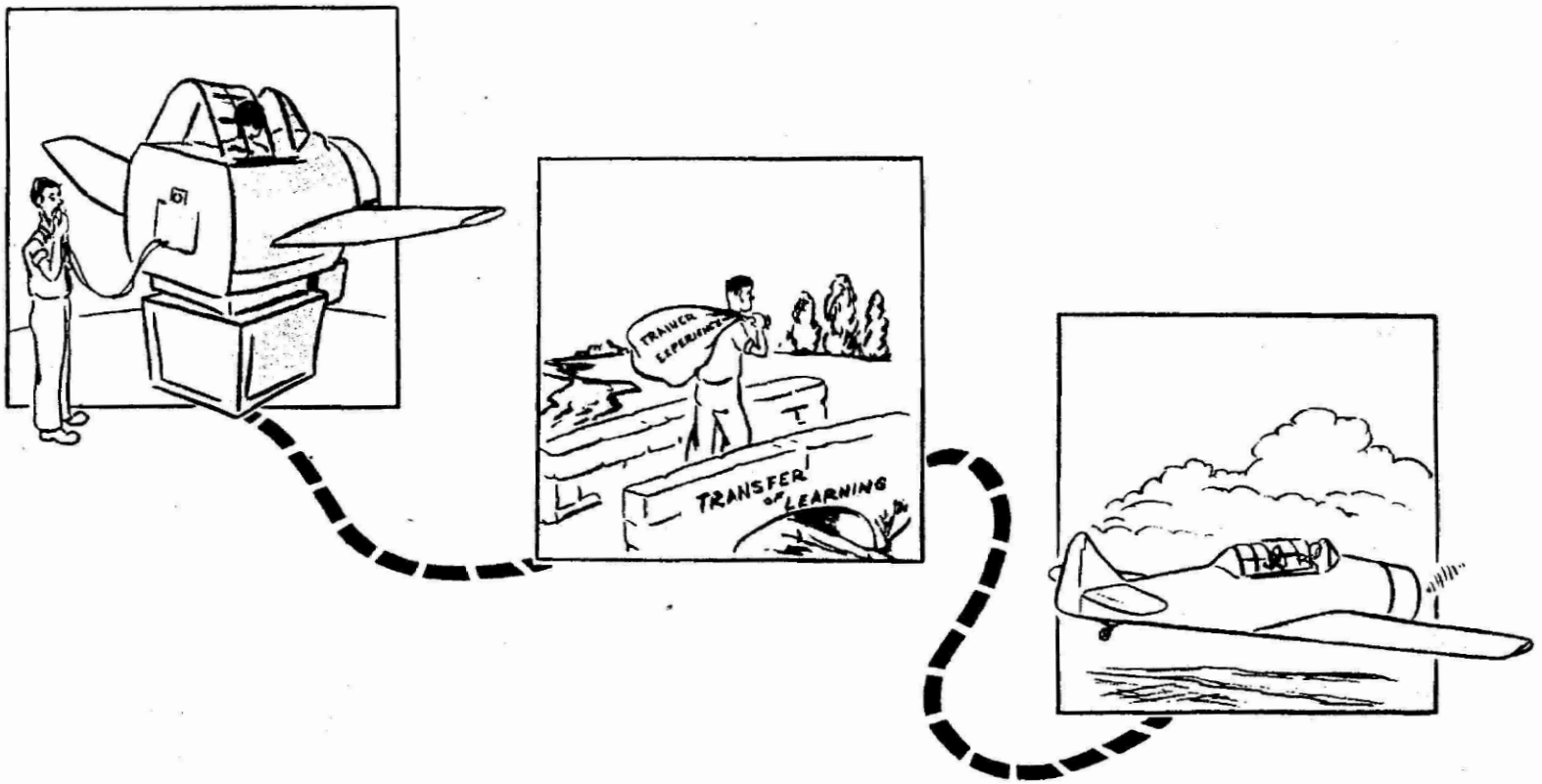
University of Illinois, a seasoned civilian pilot,  veteran Naval Air Force flight instructor, and  transport pilot, now consultant psychologist to USAF, Navy Special Devices Center, and National Research Council, and Ralph E. Flexman,  a former AAF flight instructor now with the 

and a graduate student in the 

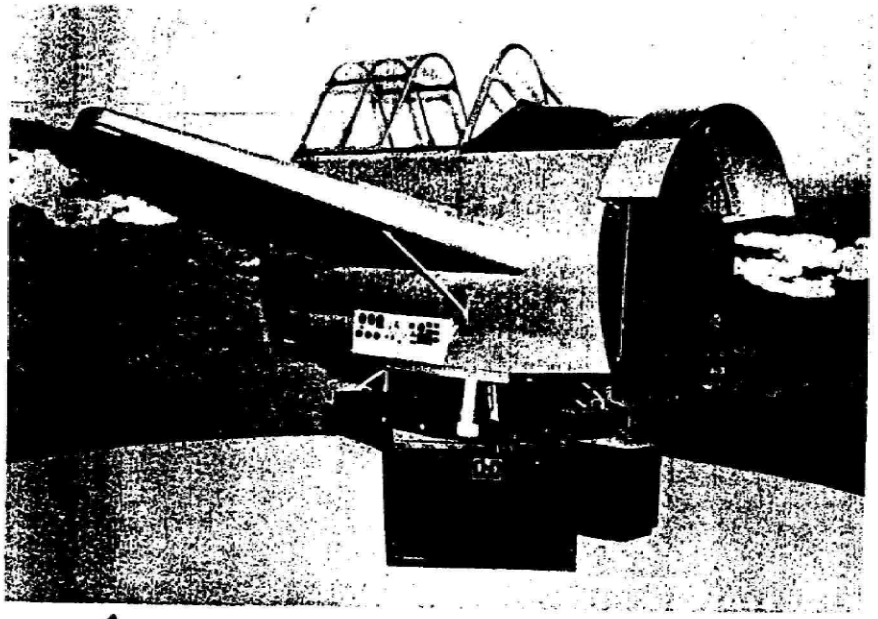
University of Illinois.

PURPOSE...

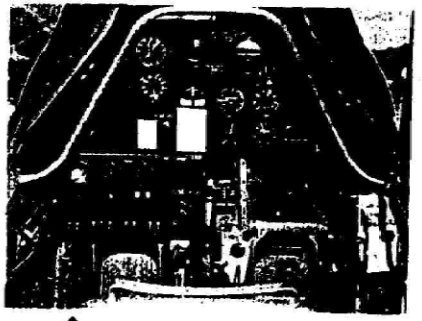
This evaluation was made in order to ascertain if certain aspects of basic contact flight training could be learned successfully in a ''synthetic flight'' trainer.



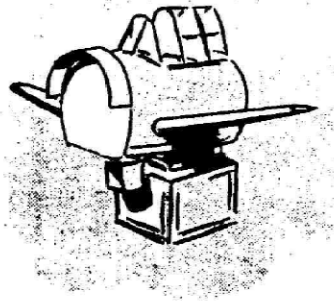
EQUIPMENT...



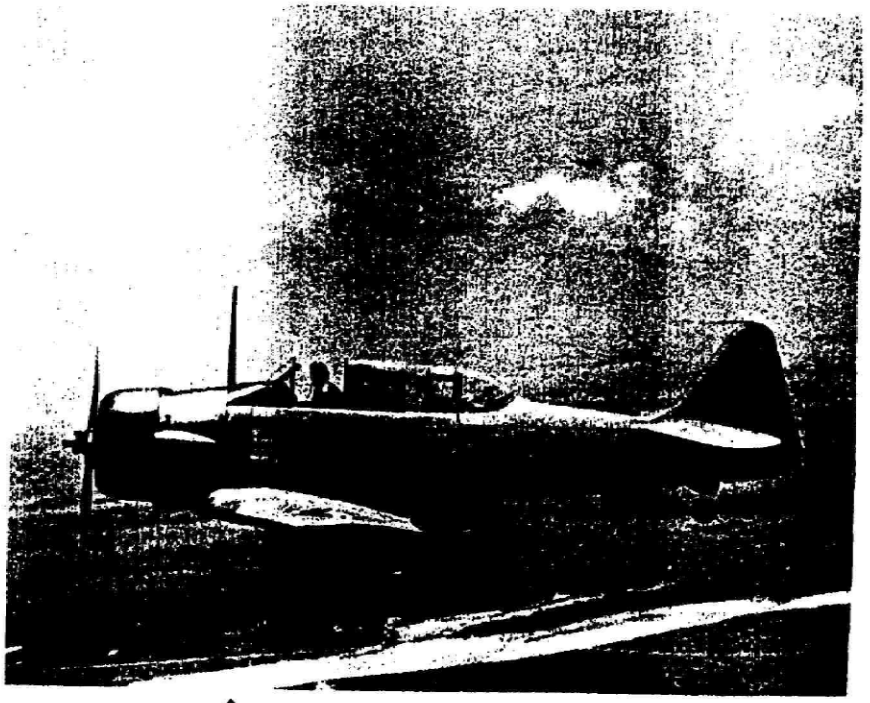
The Link SNJ Operational Trainer



Trainer Cockpit - Front View



Trainer Instructor's Station

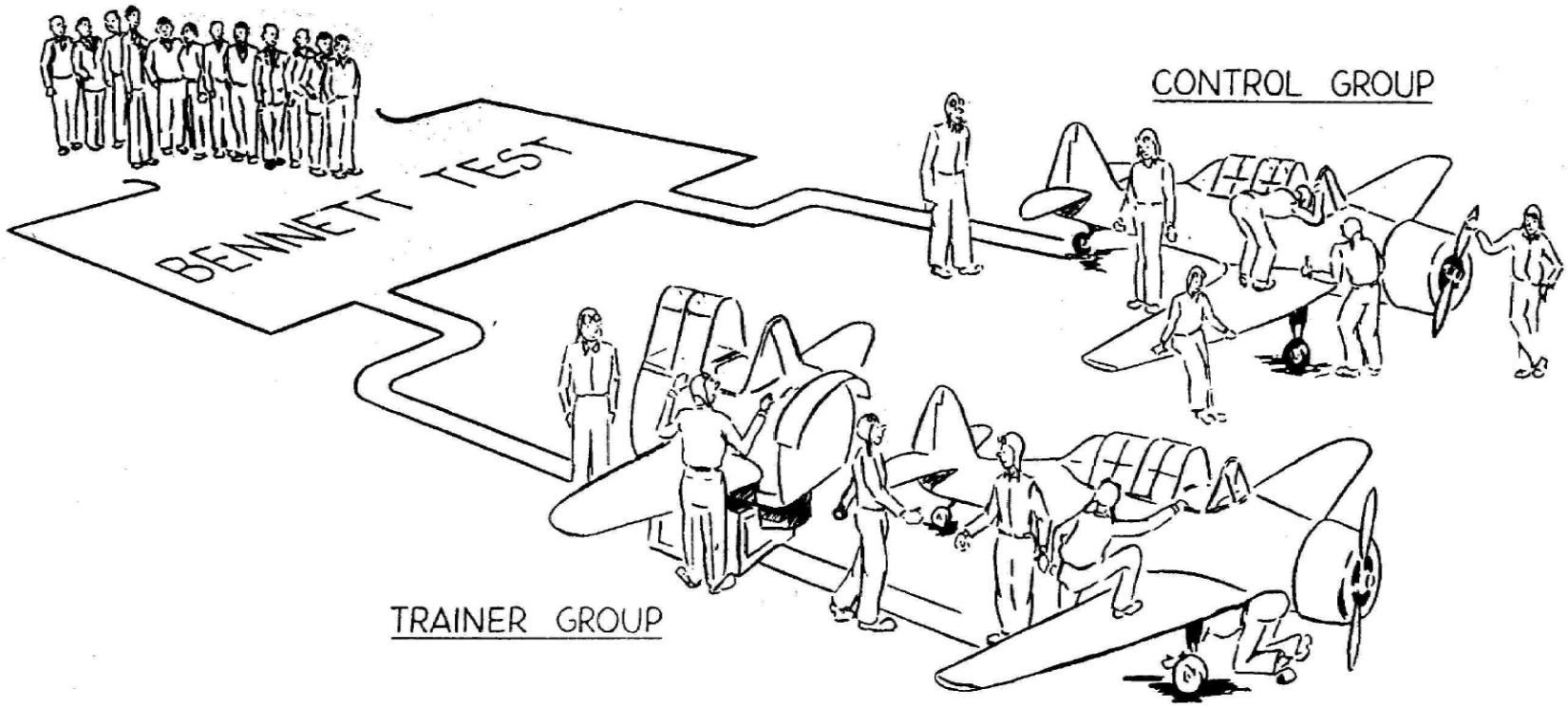


The SNJ (T-6) Aircraft

EVALUATION PROCEDURE...

The test groups were chosen in the following manner:

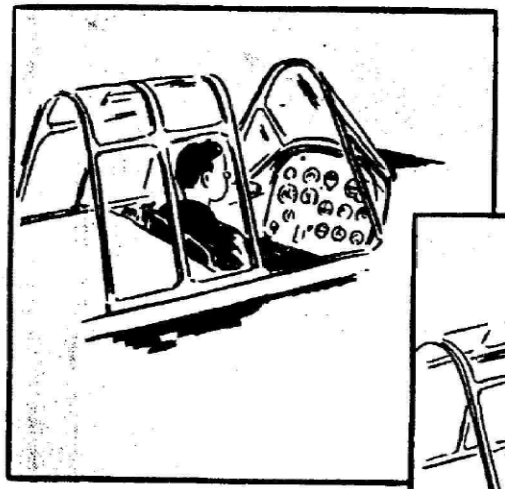
- 12 students, none with previous flight instruction, were chosen from the student population of the University of Illinois.
- Each student was given the Bennett Test of Mechanical Comprehension, Form BB, a test known to correlate with ability in primary flight training.
- The students were divided into two groups of six each, according to their test scores, in an attempt to equate the flying ability of the two groups:
  - Trainer Group - performed maneuvers both in Link SNJ Operational Trainer and in aircraft.
  - Control Group - performed maneuvers in aircraft only.



FLIGHT SYLLABUS...

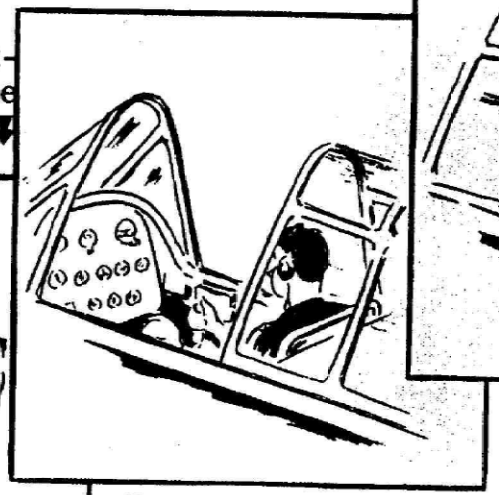
The syllabus includes cockpit procedure, basic contact air work, traffic pattern flying:

- 13 exercises --- each learned in turn.
- 370 individual items --- students' proficiency checked and scored on each item.
- 12 hours air time --- time required simply to learn exercises the first time.



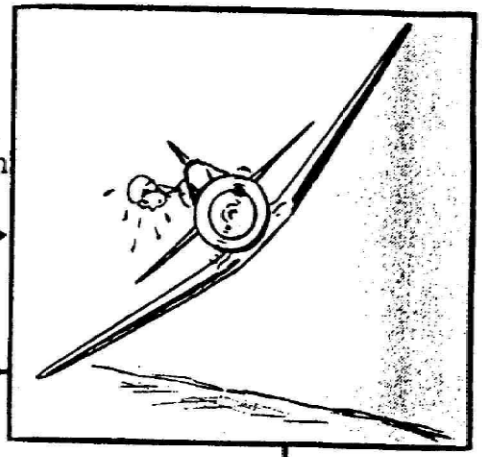
1 Visual cockpit check - Time measurement

2 Blindfold cockpit check-Time measurement

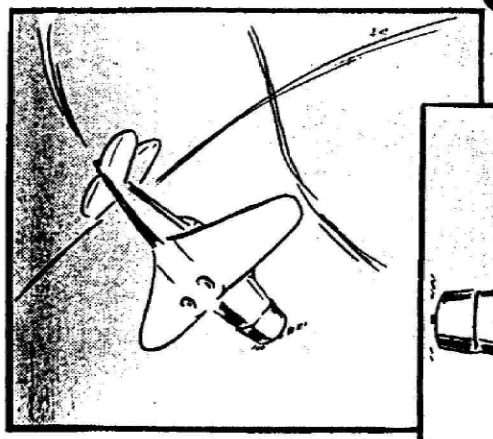


3 Starting procedure - 17 items

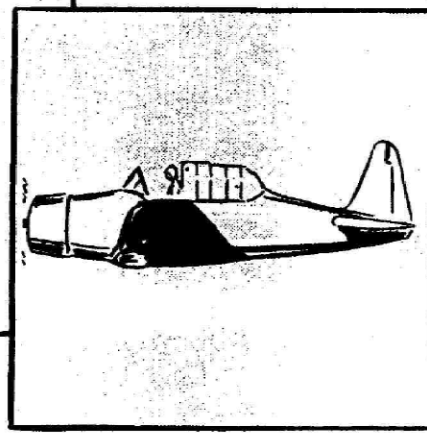
4 Engine run-up check - 26 items

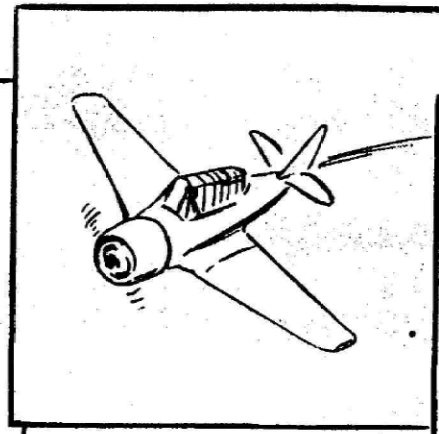


5 Effect of flight, power, and trim controls - 31 items

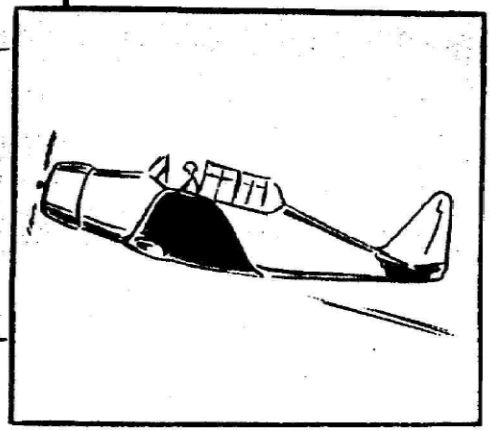


7 Straight, level flight at normal, slow, fast cruise - 26 items ⬇





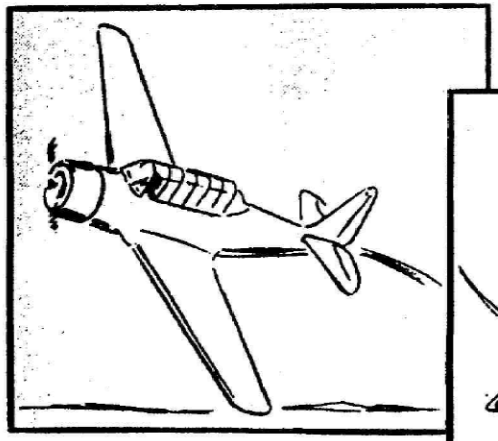
9 Straight climbs and glides - 33 items ⬇

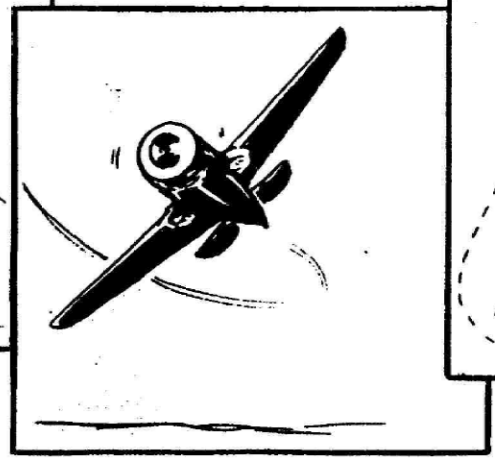


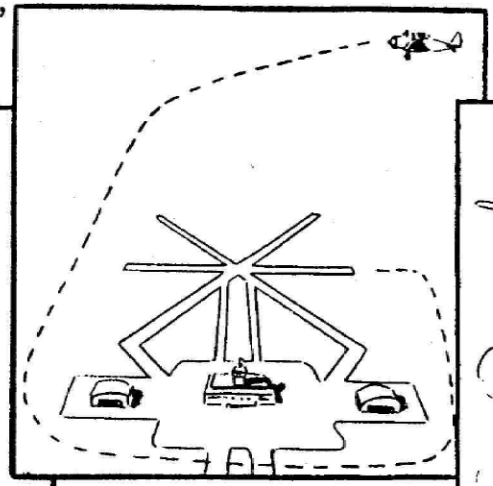
6 Return to straight and level flight from normal and abnormal attitudes - 20 items ⬆

8 Level turns-90-360, shallow, medium, steep banks-38 items ⬆

11 Normal stalls, power on-off, straight ahead, climbing, gliding attitudes-99 items ⬇





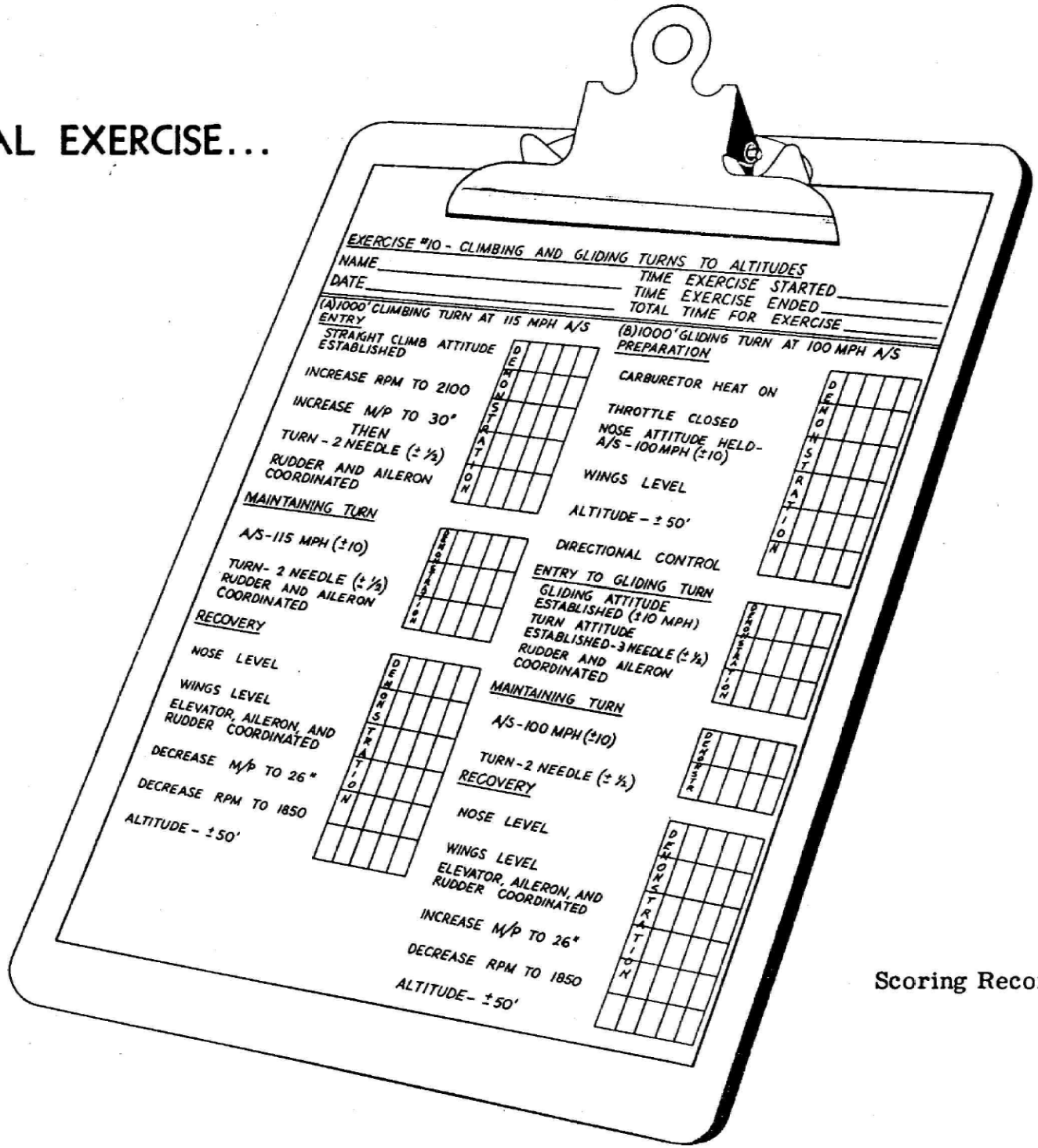


13 Flying traffic pattern-29 items ⬇

10 Climbing and gliding turns to altitude - 39 items ⬆

12 Entry to traffic pattern-12 items ⬆

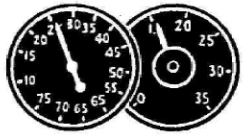
A TYPICAL EXERCISE...



Scoring Record

TOLERANCES USED...

Reference to calibrated instruments provided an objective check on tolerances.

Power Adjustment  ± ½" Hg manifold pressure; ± 50 rpm

Directional Control  ± 10°

Aileron-Rudder Coordination  ± ½ ball

Bank  ± 5° (on artificial horizon)

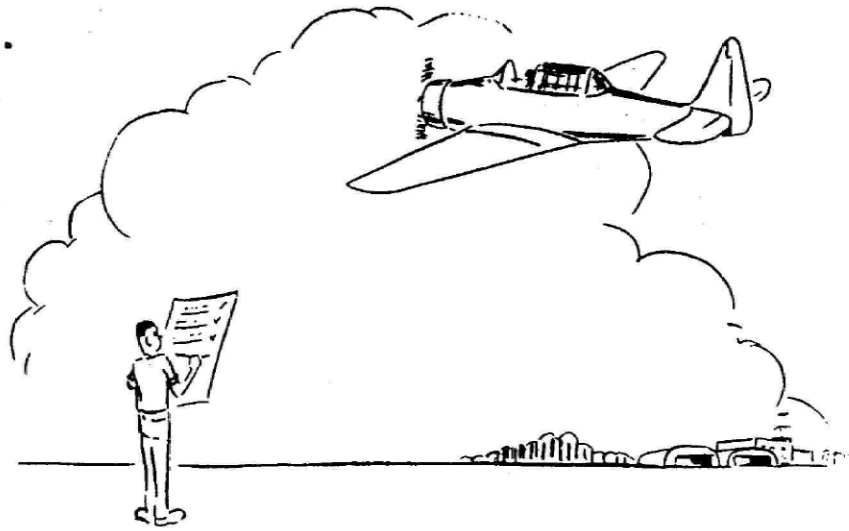
Altitude  ± 50' (100' in steep turns)

Airspeed  ± 10 mph

STANDARD OF PROFICIENCY REQUIRED...

Students were required to perform three consecutive trials per exercise:

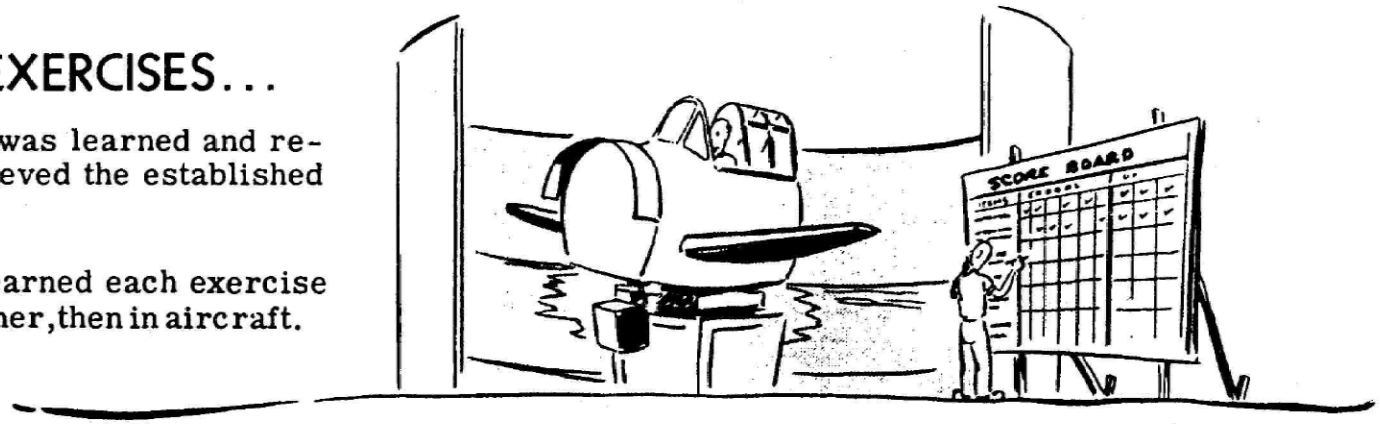
- A trial was the performance of a complete exercise.
- An errorless trial was made when all the items in an exercise were performed within the tolerances established.

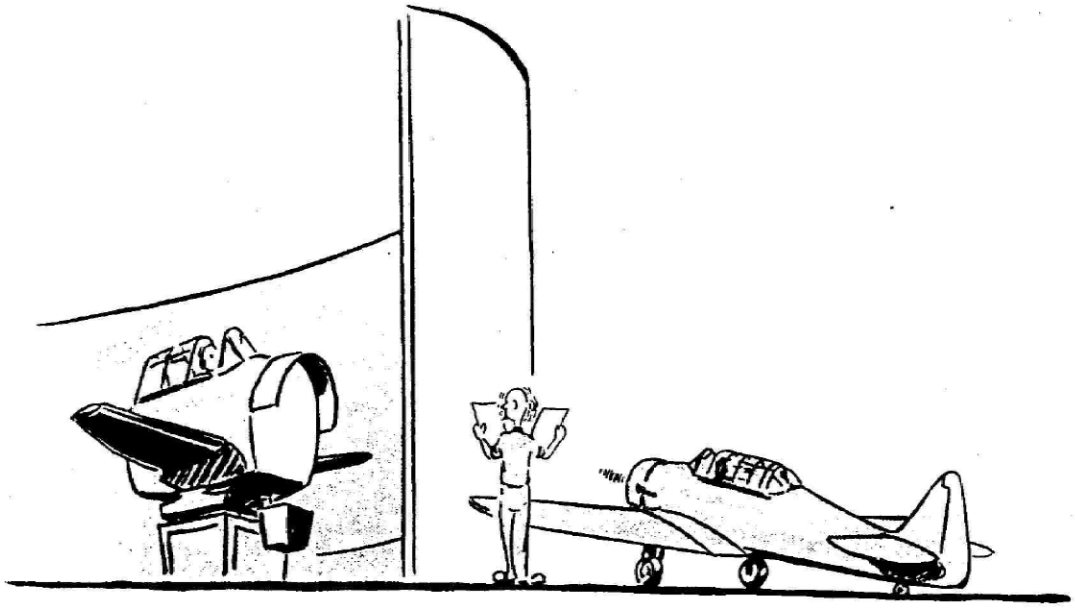


CONDUCTING THE EXERCISES...

Each exercise in turn was learned and repeated until the student achieved the established standard of proficiency:

Trainer group learned each exercise first in the trainer, then in aircraft.





Instructor influence was held to a minimum:

- The same instructor handled both groups throughout the syllabus.
- The instructor gave one demonstration at the start of each exercise; infrequent later demonstrations were given as needed --- they were counted as trials.
- Upon completion of a trial containing errors, the instructor pointed them out and suggested means of correction.
- If a trial was errorless, the instructor made no comment.

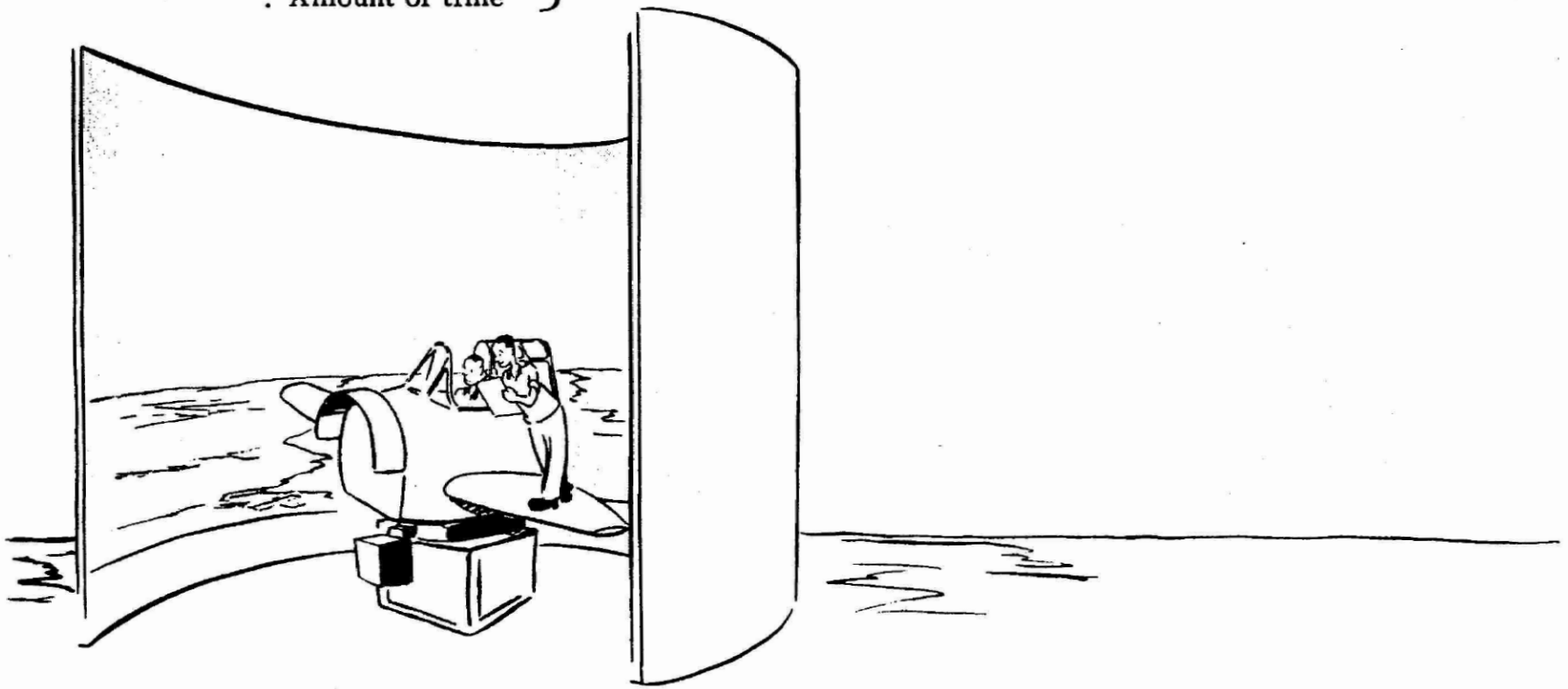
SCORING AND RECORDING STUDENT PERFORMANCE...

Performance on each item was scored with relative objectivity by reference to calibrated instrument readings.

Scoring was done by recording:

. Number of trials
. Number of errors
. Amount of time

} required by student to reach established standard of proficiency.



RESULTS...

TRIALS REQUIRED

Trainer Group: 544 (in Aircraft) + 774 (in Trainer) — 1318 Total

Control Group: 1418 (in Aircraft)

ERRORS MADE

Trainer Group: 563 (in Aircraft) + 847 (in Trainer) — 1410 Total

Control Group: 2074 (in Aircraft)

TIME REQUIRED (IN HOURS)

Trainer Group: 26:57 (in Aircraft) + 48:20 (in Trainer) — 75:17 Total

Control Group: 70:33 (in Aircraft)

COST OF TRAINING

	Aircraft Cost	Trainer Cost	Total
Trainer Group	$1347.50	$225.00	$1572.50
Control Group	$3572.50		$3572.50

Aircraft Cost - $50 per hour

Trainer Cost - $5 per hour

SUMMARY...

TRAINER GROUP

1. REQUIRED 874 FEWER TRIALS - A 62% SAVING
2. MADE 1511 FEWER ERRORS - A 75% SAVING
3. TOOK 43:36 LESS AIR HOURS - A 62% SAVING

On a 12-hour Syllabus

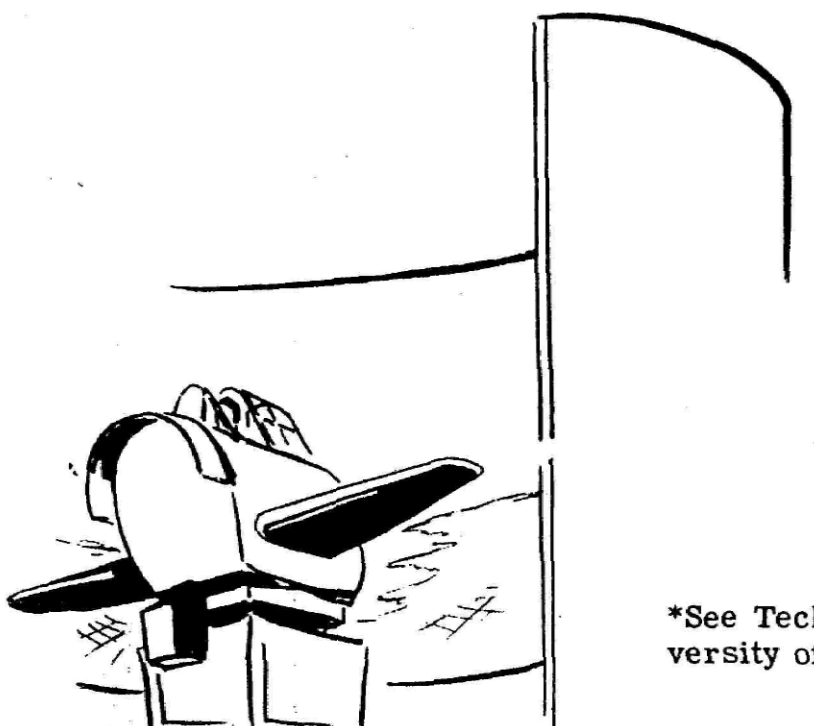
-THAN CONTROL GROUP!

ANALYSIS OF RESULTS...

The reliability of the observed difference between the Trainer Group and the Control Group was tested by appropriate methods* (the "x^2" test of significance; the "t" test) and revealed that:

The difference between groups can be attributed to:

THE EFFECT OF THE LINK SNJ OPERATIONAL TRAINER.

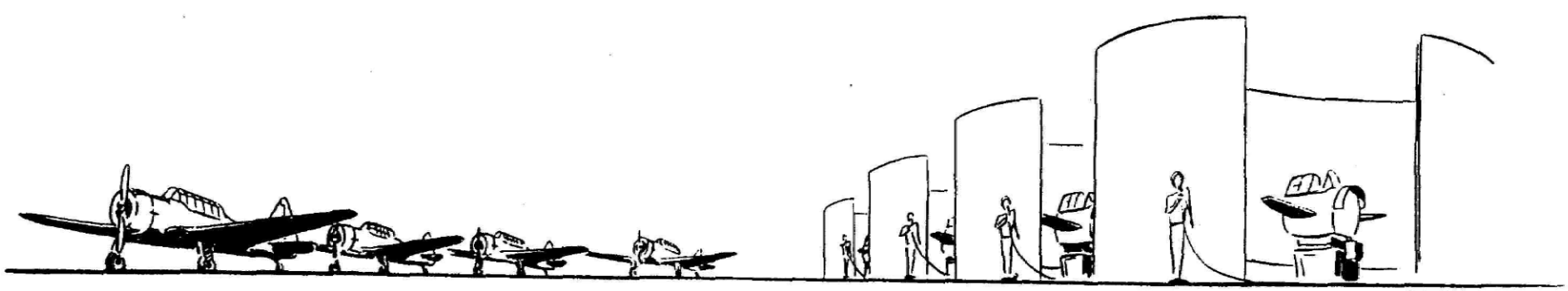


*See Technical Report --- Special Devices Center 71-16-3 by the University of Illinois Department of Psychology, July, 1949.

INTERPRETATION OF RESULTS...

While it is safe to expect that similar results would be found with other and larger sample groups, they could be expected only if the following conditions under which they were obtained were similar:

- The trainer used must accurately simulate, both in cockpit configuration and in flight characteristics, the aircraft to be used.
- The same instructor should teach the students both in the trainer and in the aircraft.
- Standards of proficiency which can be measured objectively by reference to calibrated instruments must be agreed upon before instruction starts.
- A detailed objective method of recording student performance must be maintained.

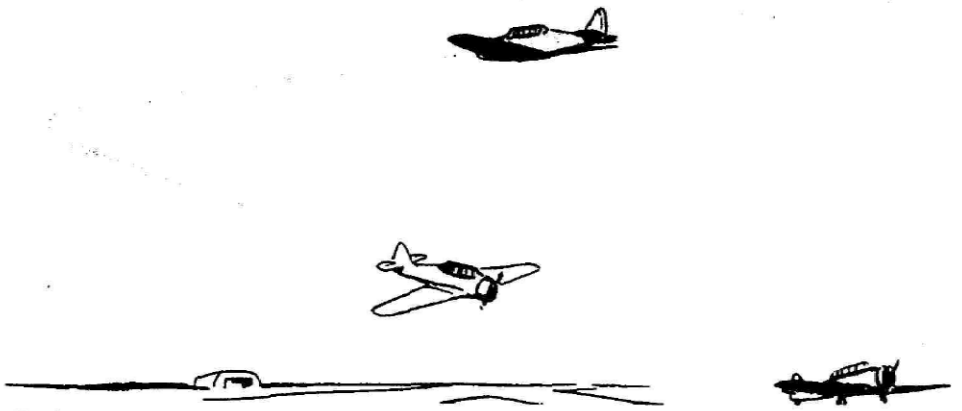


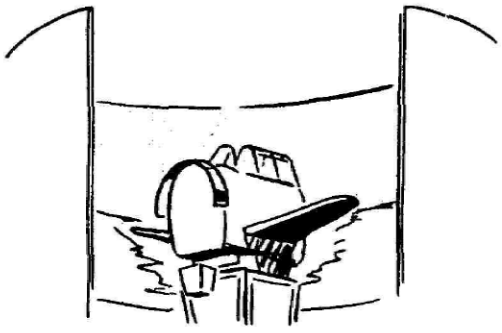
APPLICATION OF RESULTS TO ROUTINE FLIGHT TRAINING...

This evaluation demonstrates the effectiveness of the Link SNJ Operational Trainer as used in teaching cockpit procedure, basic contact air work, and traffic pattern flying, which are parts of a complete syllabus.

The effectiveness of the Link SNJ Operational Trainer, as shown in this evaluation, suggests the following:

- The trainer can be used profitably throughout the entire contact flight training syllabus.
- The SAVINGS found would be increased in proportion to the increased use of the trainer throughout the syllabus.
- If instrument flying training is included in a basic contact flight syllabus, the SAVINGS already found for contact work would be increased by at least 60% of the time allotted for instrument training.





CONCLUSION...

The findings of this evaluation are of immediate and paramount importance to those concerned with flight training because:

. The practical application of these findings will result in a SAVING of:

. MONEY

. TIME

. LIVES