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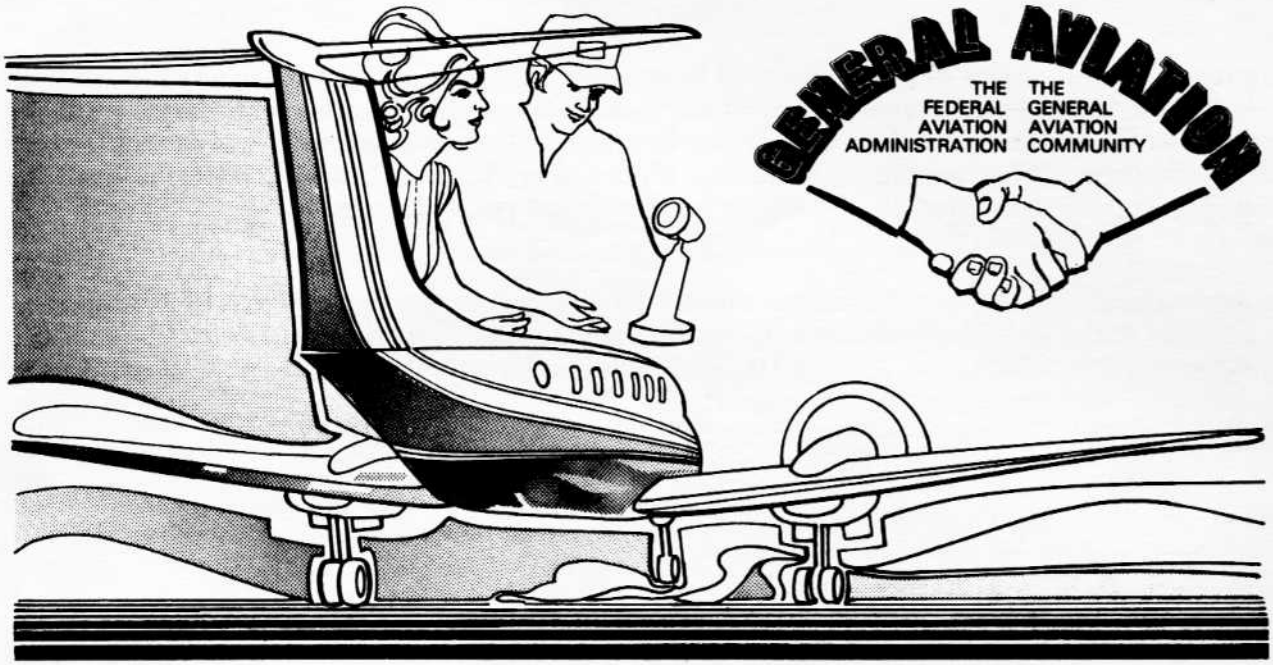


GENERAL AVIATION
THE FEDERAL AVIATION ADMINISTRATION
THE GENERAL AVIATION COMMUNITY

accident prevention program

ON LANDINGS

PART I

U.S. Department of Transportation
Federal Aviation Administration
Washington D.C.

ON LANDINGS
Part I

Being a safe pilot means combining your working knowledge of aviation with current skills and experience—tempered by good judgment.

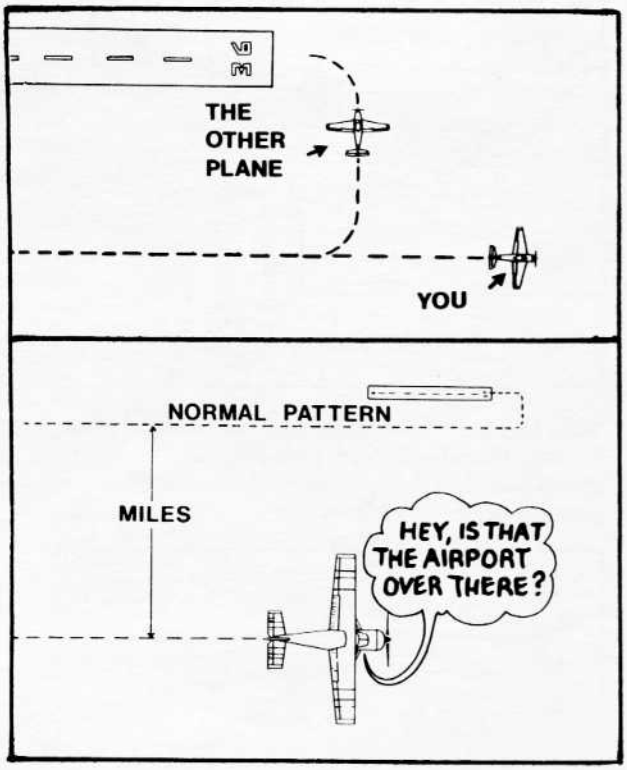
One important phase of flying skill is the landing. Landing phase accidents are responsible for nearly half of all general aviation accidents. By fortifying your knowledge of the "whys" and "wherefores" of approach and landing accidents, you can become a safer pilot.

In this handout we'll look at undershooting and cross-control stalls—the kinds of accidents which can happen *before* you reach the runway. Also, we'll look at hard landings, porpoising, and loss of directional control—problems encountered *after* reaching the runway.

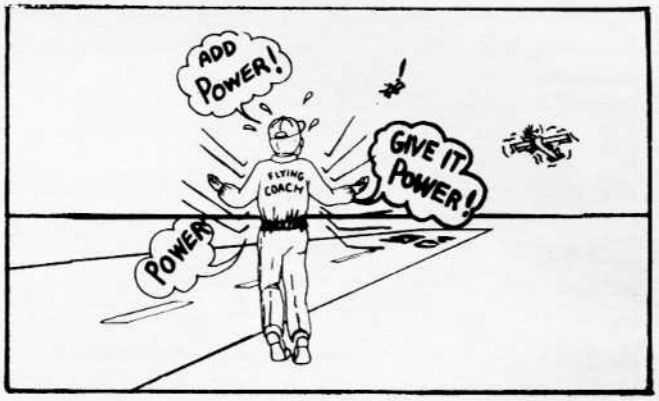
THE UNDERSHOOT

At one time or another every one of us has miscalculated an approach and started to undershoot the runway. It's hard to forget that "sinking" feeling you had when you first realized that the airplane might not make the runway.

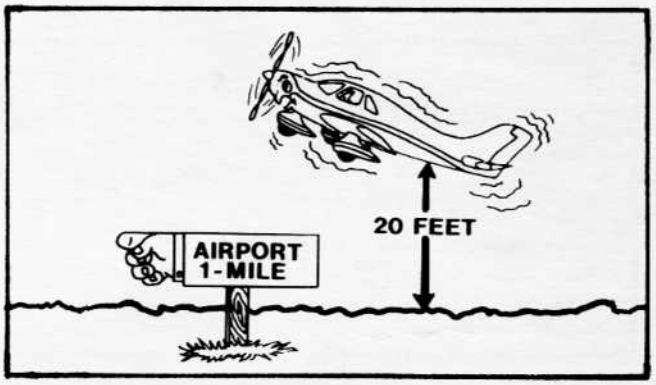
Poor pattern techniques such as flying too wide a pattern on downwind, or making a late turn to base leg are frequent causes of undershooting.



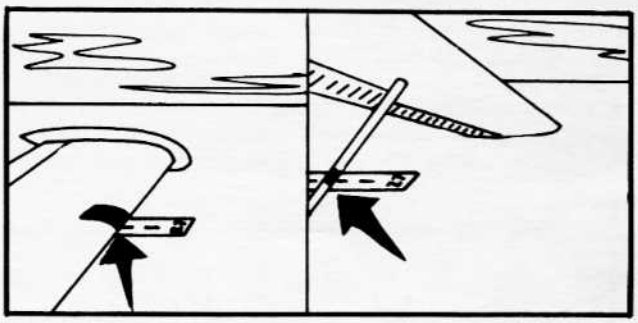
Another cause is failure to maintain adequate power on final.



Some pilots succumb to "runway fixation" and unconsciously try to "carry" the airplane up to the landing spot by easing the nose up without adding power—this doesn't work very well.



You can help set up a proper and constant distance from the runway for *all* airports by placing the runway centerline at a specific point on the leading edge of the wing (low wing airplane) or a point along the strut (high wing airplane). You may even put a mark or piece of tape at the proper wing strut position.

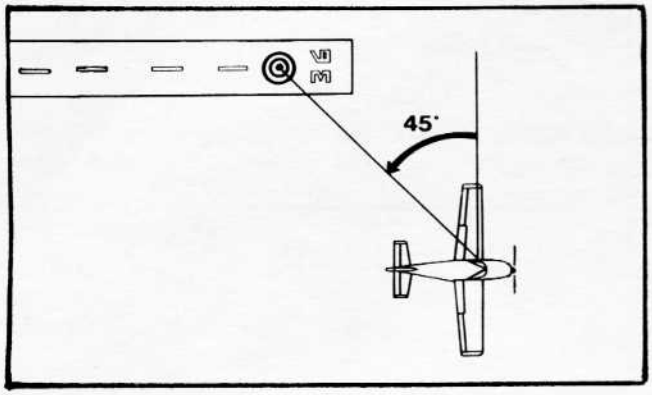


Using the runway centerline as your guide takes care of wide *or* narrow runways. (Of course, this reference line or point only works when the wings are level.)

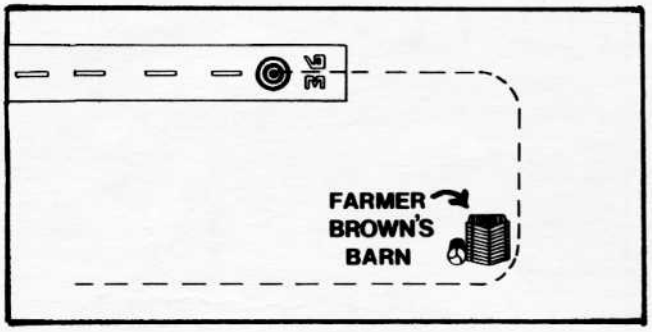
Avoiding Undershoots

How do you avoid undershoots? A good pattern helps.

When traffic isn't a factor, turn base when the point of intended touchdown is 45 degrees behind the wing.



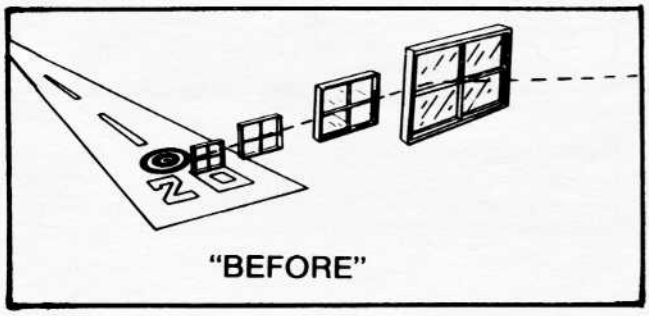
At a familiar airport, you may be able to use the "crutch" of familiar landmarks to determine proper turning points. But at unfamiliar airports you won't have such "hometown" references.

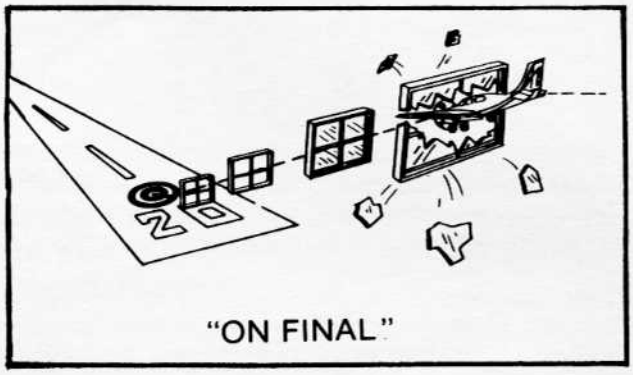


The 45 degree technique will work at *any* airport.

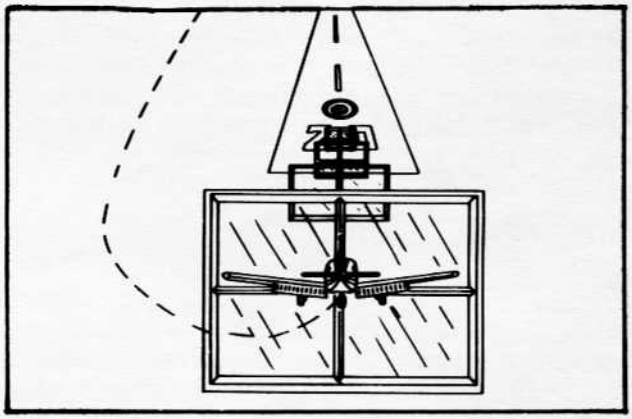
When there is other traffic in the pattern, you can avoid the common problem of the "ever-lengthening downwind" by starting your turn to base just after the airplane you're following turns final and passes behind your wing (assuming that it's not using a much slower approach speed than yours).

Experienced pilots often use a series of imaginary windows on approach. These "reference points in the sky" are great aids in determining whether your approach is within the desired horizontal and vertical limits.

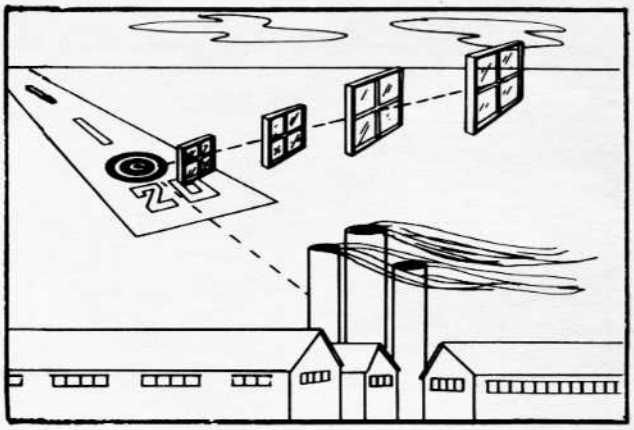




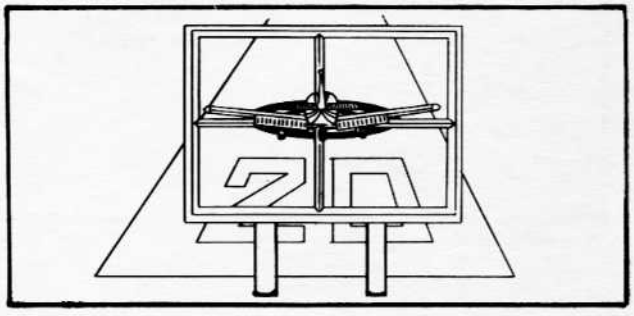
The first window should be encountered just after turning final.



If there are obstacles between your imaginary window and the runway, either raise the "windows" or move them.



Your last and most important window is the one at the runway threshold. You should be at the required airspeed and height to complete the landing when you pass through this last window.



Flying the Right Airspeed

Pilots of large aircraft always determine what their approach speeds will be in advance. They calculate the aircraft's landing weight, then look at charts for the right "reference speed, " or V-ref. The keystone V-ref, although different on almost every approach, is based on the airplane's stall speed and other factors at its estimated landing weight.

Added to V-ref by the pilot is additional airspeed required to maintain an adequate safety margin while maneuvering in the pattern as well as additional airspeed to compensate for wind gusts, turbulence and wind shear.

V_{REF+}_____

EXTRA AIRSPEED FOR BANKING AND MANEUVERING

"Approach segment airspeeds," based on V-ref, assure that the aircraft has just the right amount of extra airspeed margin above V-ref.

Smaller aircraft do not come with V-ref tables. Some manufacturers, however, furnish recommended approach speeds corresponding to different aircraft weights.

Such tables can be developed and it is suggested that you prepare and use your own. We recommend that you use the format in the following table, but before you fill it in, we suggest that you see Part II of "On Landings", and read the accompanying handout for Part II carefully.

(CUT OUT ALONG DOTTED LINE)

V-SPEEDS

LANDING WEIGHT _____

	KNOTS-IAS
PRE-PATTERN	_____
DOWNWIND	_____
BASE	_____
FINAL	_____
SHORT FINAL	_____

(CUT OUT ALONG DOTTED LINE)

There are rules-of-thumb, however:

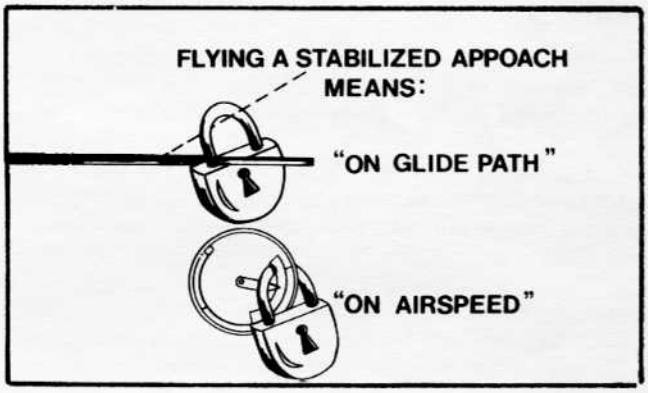
1. On downwind, fly no faster than the "top of the flap operating range" and no slower than 1.4 times the calibrated stall speed for your airplane at its *actual* landing weight, or 1.4 Vso. (There are exceptions, so please read Part II.)

2. Maintain an airspeed no lower than 1.4 Vso until after turning final.

3. Then, on final, let your airspeed decay to 1.3 Vso as you near the runway.

4. If you encounter any turbulence, wind gusts or wind shear, compensate with additional airspeed on each segment of the approach.

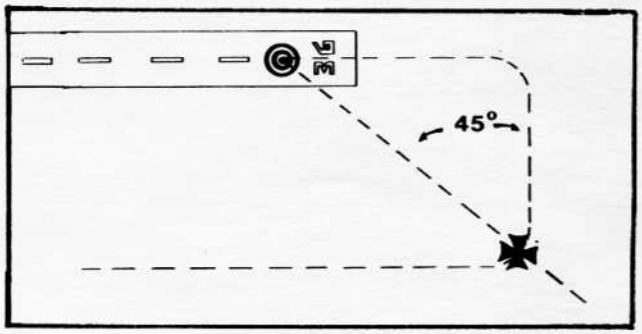
The Stabilized VFR Approach



Make your normal pattern entry and extend your landing gear on downwind, if applicable. Abeam the intended landing point, reduce your power to the predetermined value that works best for your airplane. While holding altitude with pitch, slow the airplane down in preparation for turning base.

Then set partial flaps, if you haven't already done so. If you have reduced power properly, you can now trim the aircraft and set up a descent.

Begin your turn to base when the point of touchdown is 45 degrees behind the wing. Turn base, then final, keeping all banks to 30 degrees or less.



Should you need to increase your rate-of-descent, do so either by reducing power or by further extending flaps to increase drag. If you do extend flaps, remember that you've just modified your approach configu-