Introduction

There are two prerequisites to becoming a good Bonanza pilot—one relating to skill and the other to knowledge. First, you have to develop the skill to get the airplane to do what you want. Second, you must acquire sufficient aeronautical knowledge to want the airplane to do the right things in the first place. Let me elaborate.

The first type of ability, getting the airplane to do what you want it to, primarily involves physical dexterity and hand-eye coordination. At this stage we develop a "feel" for the airplane, exhibiting enough finesse with the controls for smooth, coordinated approaches and landings. The Bonanza is designed well enough that these sorts of operations are, with practice, soon done gracefully by any pilot of average ability. Years of Bonanza experience might instill in us a feeling for the characteristics and rhythms of the airplane that no book could pass on, but even this level of "feel" is but a small part of what it takes to become a good Bonanza pilot.

The second prerequisite, that of knowing what the airplane ought to be made to do in any situation, is not learned even from years of routine experience in the airplane. Instead, it is primarily learned by hours of quiet study at home. For instance, you may have legendary skill with the yoke and yet be at a total loss when it comes to picking the speed for maximum range in a low fuel emergency or determining the proper weight-adjusted speed for rough air penetration. These operations have nothing to do with "feel," finesse, or coordination, and they are not outlined in so many words in the *Flight Manual*. Knowledge of the proper speeds comes from careful study of aerodynamic theory and application of the results to the specific airplane. That means it takes some book work and some *systematic* exploration of the Bonanza's flight characteristics to become a good Bonanza pilot. This book is designed to help.

I think that your safety in the Bonanza is directly proportional to your willingness to make a science of your flying strategy, your willingness to make Bonanza pilot technique a sub-specialty, second only to your profession. But the problem you encounter, even if you

are willing to do this, is that there is no readily available source book. It is true that there is more written on the Beech Bonanza than any other general aviation airplane, but amazingly, there is no book dedicated to exploring the Bonanza's flying characteristics. Larry Ball's *Those Incomparable Bonanzas* (McCormick-Armstrong Company, Wichita, 1971) is an excellent book about Bonanza history and model variations, and it should be on every Bonanza pilot's shelf. Norm Colvin's *Colvin's Clinic* (McCormick-Armstrong, Wichita, 1984) puts years of Bonanza maintenance experience in the hands of every pilot and should be required reading. The Beech Pilot Operating Handbook (POH) and Airplane Flight Manual certainly has a lot to say about flying the Bonanza; but while it is quite comprehensive in its presentation of performance data and check lists, it is altogether silent on a number of important operational items like short field takeoff technique, stall characteristics, maximum range speeds, and many other areas. Last, but by no means least, the Bonanza pilot is fortunate in having over one thousand pages of shared Bonanza experience packed into the cumulative issues of the American Bonanza Society's *Newsletter*. These unique documents are a must-have item for any serious Bonanza pilot. Where else can one get so many first hand accounts of diverse Bonanza phenomena like ditching, flying in ice, or mixture distribution patterns. But still, none of these books is dedicated solely to improving one's Bonanza flying skills.

This book is intended to complement, not compete with, the other books just mentioned. There is nothing here, for example, on the model to model evolution of the Bonanza or on systems *per se*. This is a book on “stick and rudder” for the Bonanza. In fact it is very close in its intent to Wolfgang Langewiesche's classic *Stick and Rudder* in that it is not a comprehensive text on flying—there is nothing here on weather or navigation, for example—it is instead about the development of proper technique for handling an airplane.

The present book asks a lot of the reader. You are expected to follow the logic of some classical aerodynamic derivations, and perhaps do some algebra in the margins, or even some calculus in the optional appendices. And in addition, numerous flight experiments

are suggested, each one designed to reveal some important characteristic of the Bonanza. For instance, every pilot knows that getting maximum miles per gallon from the remaining fuel sometimes becomes the pilot's paramount objective. Most manuals, including the Bonanza manuals, don't offer a clue about how to do this. In this book we carefully examine the theory behind maximum range flight and see that max range at any given weight occurs at a single indicated airspeed, which is valid for all altitudes. This speed maximizes the lift/drag ratio and is called $V_{L/Dmax}$. We then outline a simple in-flight experiment which will reveal $V_{L/Dmax}$ for your Bonanza. We further show theoretically how to adjust this target airspeed for variations in weight or headwind.

Some may feel that all this is too theoretical and technical, but it is my feeling that safe flying demands knowledge of and respect for certain fundamental facts from aerodynamics. And it is my belief that Bonanza pilots recognize the truth of this and would be willing to do the requisite homework if only they would be offered some guidance. In fact that is the sole purpose of this book.

So no apology is offered for the difficulty of some sections of this book. I have made an effort to hold the technical-mathematical content to a minimum, but if there is an important fact (like the propositions regarding Va or $V_{L/Dmax}$) that cannot be understood any other way, then I have no hesitation about leading the reader into (and hopefully out of) whatever technical-mathematical thicket is necessary for a reasonably full understanding.

Consider this: The U.S. Navy uses the T34C as its basic trainer. With some oversimplification, this is essentially a 4300 pound Bonanza with a Pratt & Whitney PT6 turbine engine. Most general aviation pilots would think of the T34C as a fairly “hot” airplane, rather than a trainer. Yet the typical Navy pilot will solo a T34C after only 26 hours dual. How is it that the Navy succeeds in starting its pilots in such an advanced airplane? A part of the answer is that before the Navy Cadet ever sets foot in the “Bonanza,” he or she must complete an intensive 14 week ground school including, among other things, a fairly sophisticated course in aerodynamics. Even a cursory look through their text, *Aerodynamics for Naval*

Aviators, demonstrates that the Navy expects more aerodynamic understanding from its pre-solo cadets than the FAA requires of a flight instructor or even an Airline Transport Pilot applicant. And this was true even during the Second World War, when the Navy was trying to turn pilots out "in a hurry." Apparently the Navy feels that a thorough grounding in aerodynamics is a *sine qua non* for a competent aviator. The surprising thing is that anyone else should think otherwise.

The layout of the book is as follows: In Part I we begin by exploring some facts about the external characteristics of the various basic Bonanza types, i.e., 35-B35, C35-V35B, 33-G33, 36-A36, B36TC. Included is a fairly careful analysis of the NACA 23000 series airfoil, which all Bonanzas use. What we are looking for are design features that have important operational implications. There is a fairly exhaustive discussion of the Bonanza maneuver-gust envelope, with much space given to the determination of weight-adjustments for Va. The chapter on handling qualities is concerned primarily with stability characteristics, stick forces in various regimes, stall qualities, and trim effects. We give a particularly thorough examination of lateral (spiral) stability. Finally, we include a chapter on aerodynamics of the V-tail, since most other sources available to the Bonanza pilot have barely any mention of the V-tail.

In Part II, we have a chapter given to each of the basic phases of flight, including a full chapter on instrument operations "by the numbers." We give particular attention to items which are not well covered in the Beech manuals, such as use of flaps on takeoff, leaning by EGT, and use of various speeds for enroute climb.

Part III is a fairly methodical treatment of weight and balance issues for Bonanzas. In the chapter on weight, we go through the various formulae for predicting performance changes with weight. There is a separate chapter on the theoretical implications of cg, including stick force changes in Bonanzas and stall/spin recovery differences for fore and aft cg's. Finally, we have a chapter covering the major loading issues for the various models.

The section on emergencies focuses primarily on problems not covered in the flight manuals. If the engine catches fire in flight,

follow the Beech check list in the Emergency Procedures section. I have nothing substantial to add to that. But there is much to be said here about developing a strategy for maintaining control in turbulence. For instance, what speeds and configurations work best? We also look into the theory and practice of flying for maximum range and the determination of the minimum safe turn-back altitude in the event of an engine failure on takeoff. Some occasionally fatal non-emergencies, like a door latch failure, are also covered.

The postscript gives a final wrap up on Bonanza speeds. There is a proper speed for every operation, and it is my contention that fifty percent of safe Bonanza technique consists of knowing the speeds and being able to smoothly configure the airplane to achieve those speeds. Some final hints are offered.

This project has benefitted substantially from the help and suggestions of many people. Foremost are my fellow American Bonanza Society Pilot Proficiency Program flight and ground instructors—Sam James, Ken Pearce, John Howard, Bill Hale, Hank Canterbury and MacKenzie Patterson. I have learned more about Bonanzas over lunch with this group than I have learned from all other sources combined. Thanks are also due to: Cliff Sones, former Administrator of the American Bonanza Society; Frank Ross, former ABS President; Ottis Cameron of Alcor; Continental Motors; Bruce Augustus; Al Strickfadin; Karen Kister; Roxanna Glang-Nairz; and Walter L. Eckalbar, Jr., my father, flight instructor, and flight data recorder. And special thanks to Paul Bowen for all of the beautiful Bonanza photos.

Two important caveats are in order before we get to the text. First, this book reports on many in-flight experiments having to do with airspeeds, power settings, climb rates, etc. These results were gathered from flying a very large sample of typical Bonanzas from the fleet. And though my results are no doubt reasonably accurate for the representative Bonanza, I cannot claim perfect accuracy in all applications. There are several reasons for this, but most important is the fact that no two Bonanzas are exactly alike. They differ in propeller blade efficiency, actual engine power output, rigging, and external aerodynamic modifications such as gap seals and tip tanks,

etc. So what is true for one Bonanza's performance need not be exactly true for all others. In addition, all of our results were obtained in aircraft with standard, factory installed, engine and pitot-static instrumentation, which is subject to error.

The second caveat is this: There is nothing in this book, either on or between the lines, which advocates operating the Bonanza contrary to the limitations printed in the Pilot's Operating Handbook and FAA approved Airplane Flight Manual. I hope the reader finds this book a useful supplement to the POH, but it is in no way intended to be a substitute.

Photo courtesy of Paul Bowen. This and all subsequent photos are copyrighted by Paul Boween.