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SAFEPRO

RECOMMENDED INTERNATIONAL HANG GLIDING STANDARDS OF SAFETY AND TRAINING
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THE SAFE PRO A HANG GLIDING SAFETY AND TRAINING ANALYSIS

by Stein Arne Fossum *

The history of hang gliding has been written in a few years, where new barriers have been broken virtually every day. (Today it may suffer from a hard case of the "Icarus Syndrome".) It has developed into a full-blooded aviation activity, which means that it is no longer simple and easy to learn. It has become complex and potentially more dangerous for the "self-learners", while the opposite may be true for the ones that receive proper training.

In the race for more efficient gliders and new developments (fixed wings, power, thermal and cross country flying), one seems to forget too often that human nature needs time to learn to perform new tasks in a safe manner. The training methods are very often on the "ground skimming level", while reality calls for cross country and thermal flying.

If one looks at the history of hang gliding with respect to the levels of flying that have been reached (limited to foot launched, no power hang gliding), we see 5 distinct stages.

Accidents are most likely to happen when the pilot takes the step up to a higher stage.

The 5 stages of hang gliding:

5. CROSS COUNTRY

4. ADVANCED SOARING

(Soaring in turbulent conditions.)

3. BASIC SOARING

(Soaring in non turbulent conditions)

2. ALTITUDE GLIDING

(Altitude and space to manoeuvre, no soaring)

1. GROUND SKIMMING

(Don't fly higher than you would care to fall!)

Each stage is followed by a more complex stage (a building block system) requiring new knowledge and skills. It is a natural "ladder" where a student should climb to progress safely in his hang gliding career.

* NOTE: This article was originally written by Stein Arne Fossum when he made the SAFE PRO system in 1980-1982. The name of the stages been updated, but otherwise it is the original text. At some points it therefore may seem somewhat outdated.

We have additional stages like Aerobatic, Experimental and Power, all of which I personally consider unsafe for the general pilots at the present time. They should therefore only be performed by specialists using a strict professional program until safe methods are found to make them available to everyone.

In addition to the stage system above, there are also other stages or steps a pilot may take, such as changing to another harness system, or learning to fly a new site or a new glider.

Each time new stages are pioneered, or are being reached by the "self learning" pilots, there are an increase in accidents. Some of those accidents are unavoidable because of the pioneering nature of it (Lillienthal was the first one), while others could have been avoided simply by proper training.

If one analyses why most accidents caused by "pilot error" happen, one finds that they happen either because the pilot tries to perform a task or meet a condition he/she is not able to master, or he/she simply does something that should not be done.

Today we have all the material necessary to avoid most such accidents, either by the knowledge the hang gliding community has collected itself or by the available knowledge through other aviation activities. Either we know how a task should be performed correctly or we know that there are clear limitations that we cannot safely exceed. (One sample of the latter is cloud flying. Any sane motor or glider pilot knows that this is dangerous, and it is hence unnecessary for hang glider pilots to rediscover this fact by killing themselves).

Today, hang gliding, along with other aviation activities, has most of the information needed to progress safely through the flying stages. All that is needed is to put all together in a training system.

Let us have a closer look at the model of the stages:

The 5 stages of hang gliding:

Accidents are most likely to happen when the pilot takes the step up to a higher stage. A training system should be designed to smooth out these steps with a natural progression to higher pilot ability. We fill in these steps with instruction.

5. CROSS COUNTRY

(Brown)

4. THERMAL SOARING

(Blue)

3. RIDGE SOARING

(Green)

2. ALTITUDE GLIDING

(Orange)

1. GROUND SKIMMING

(Yellow)

A PILOT'S ABILITY to fly hang glider can be broken down to 4 QUALITIES that we can develop:

1. Knowledge
2. Skill
3. Experience
4. Airmanship

SKILL: Since hang gliding is a practical activity, a pilot's ability can best be measured by his skill, which means his way of performing maneuvers, links of maneuvers and tasks, and how he masters flying conditions and new situations. He certainly also must show good AIRMANSHIP but that is not easily measured and difficult to diagram. A good instructor however is able to spot good airmanship often before the pilot is even in the air.

KNOWLEDGE and **EXPERIENCE** are only "tools" used to improve a pilot's **SKILL** and **AIRMANSHIP** and hence his **ABILITY** as a pilot. They are however of good value in the learning process and their value as such can hardly be overestimated. Left alone by themselves they are meaningless in measuring the pilot **ABILITY**.

BASED on the above "facts" or statements, I have developed a training system, built on the **5 STAGES of HANG GLIDING** as a natural progression for a pilot. I have also based the system mainly on the development and measurement of the pilot's **SKILL**, although the other 3 qualities have found their place.

For instance, AIRMANSHIP is expressed by the fact that the pilot has either a STUDENT LICENCE, which means that he lacks the necessary AIRMANSHIP to take care of his own and others' safety, or he has a PILOT LICENCE, showing he has the necessary AIRMANSHIP. In other words, a student pilot is one that is under a training system, controlled by an instructor, and all his flying shall be in accordance with the instructor guidelines. A pilot licence shows that the holder is a pilot that is mature enough to take care of his own flying, seeking further instruction when he feels he needs it.

A pilot licence does not mean that the holder is someone that does not need more instruction because "he knows it all", but merely that he can take care of himself at the stage he is at. When he wants to progress to a higher stage he seeks instruction, before he goes out on his own flying at that stage.

THE COLOUR CODES (or "Black belt in Hang Gliding"): The stages in the system are colour coded for easy identification. The idea is that the pilot (or student) will wear visible markings that identify him as a Student or a Pilot, as well as the stage he is on (signed off by an instructor). Apart from being a good site control system it has its values as a training aid. It is motivating and it gives the students and pilots insight in what they are up to by breaking down the way to the top into easily identifiable stages or blocks that seem attainable by most people.

Note: The stages are given colours from yellow to brown. A "black" grade or Master grade may be considered as the top level. This grade should express the ultimate in Airmanship, Skill, Knowledge and Experience.

SAFE PRO, general description

The objective of this program is to aid and assist the participants to progress safely in, and enjoy, the sport of hang gliding, and become true airmen.

Which means that they must be able to enjoy the beauty and freedom of the sport, and not risk injury or restrictions due to their own and others' lack of will and ability to take care of their safety, enjoyment and freedom.

The ability of an airman is based on knowledge, skill, experience, personal qualities and attitudes, which take time to develop to a standard where one is able to operate alone within the objective above.

The development of this ability is a matter of education, which is done most efficiently, enjoyably and safely through a planned program which motivates the student and pilots by helping them to reach easily definable and natural stages or goals, which gradually expands the operational freedom without jeopardizing safety.

THE PROGRAM

The program consists of 5 natural stages, based on the development of the sport, and which gives an excellent progression after the building block principle of learning. One progresses from the easy to the more difficult, from low to high, from basic to advanced, from simple to complicated, being careful not to leave any gaps on the way.

The program also divides the participants into students and pilots which indicated whether they are able to operate alone or not.

THE 5 STAGES

1.	Ground skimming	Yellow	Student
2.	Altitude gliding	Orange	Student
3.	Ridge Soaring	Green	Pilot
4.	Thermal Soaring	Blue	Pilot
5.	Cross Country	Brown	Pilot

PARTICIPANTS:

Students:

A student pilot is as the name suggests under training to become a pilot. He is considered to have limited ability to take care of his own and other people's safety.

This means that he has not developed enough ability to evaluate all elements involved with regard to safety and based on this, make safe and sound decisions and act accordingly, without the supervision of an instructor.

Pilots:

A pilot should be able to take care of his own and other people's safety within applicable rules, regulations and code of good practice, while operating alone requires higher stages than they are rated for.

This means that he must be able to evaluate all the elements involved with regard to safety, and based on this make safe and sound decisions and act accordingly, on his own, or to obtain further instruction, information and assistance at his own discretion.

Recommended training and safety limitations

Students should always fly under the supervision of an instructor. Before all the rating requirements are met they should always fly under the direct supervision of an instructor.

Students should only fly hang gliders and harnesses suitable for students and which on they have been checked out on by the instructor. They should only do tuning and repairs when approved by the instructor.

Students should only fly demonstration or competition flying at the stages they are rated for and always under the direct supervision of an instructor.

Pilots are expected to be familiar with and to follow all applicable national aeronautical regulations and local flying site rules.

Pilots should not participate in demonstration, competition or other organized flying which requires higher standards than they are rated for.

Minimum age: To fly hang glider: the minimum recommended age is 16 years old, with the written permission of parent or guardian when below 18 years.

SAFE PRO, DESCRIPTION OF STAGE ELEMENTS:

Knowledge

Students stage 1, 2 and 3 should be given the necessary lectures, briefings, oral discussions and written tests to ensure that the required knowledge needed to meet the objectives of the applicable stage, is acquired. The listed requirements are a guide to meet those objectives. They should not restrict anybody from giving additional instruction if found necessary. The methods of instruction may vary and are left to the discretion of the organiser/instructor.

Stage 3. Before a student is signed off to become a pilot, he should pass a written test on air law, applicable rules and regulations and code of good practice, to ensure that he has all the necessary knowledge to operate alone, safely and correctly at sites and in the air.

Pilots stage 4 and 5, may at their own discretion acquire the required knowledge, either through attendance of lectures, briefings or through oral discussions and group or personal study.

Before a student or a pilot is signed off at an applicable stage, the instructor or observer must be convinced that he meets the required standard of knowledge.

Practical skills

Students stage 1,2 & 3, should be given the necessary instruction in each of the practical skills. Before a skill is actually performed, the student should be given a theoretical briefing in the basic theory, the purpose, normal procedures, mistakes, faults and dangers and their corrections, as well as the acceptable safe criteria of performance.

Each skill should be practiced until the instructor is convinced that it is mastered within correct and safe procedures and limitations for the applicable stage. The skills may be signed off progressively as the above criteria is met. A special flight test is hence not necessary.

Pilots stage 4 & 5, may at their own discretion, within acceptable safe methods, acquire the necessary instruction for each practical skill. Before the skills are signed off, they should be demonstrated to an instructor or observer, who should be convinced that they are mastered within safe procedures and limitations.

Experience

Experience is not, by itself, a measurement of pilot ability. It shall, however, ensure that the knowledge, skills and airmanship have been practiced a minimum of times in various situations. Exercise, drill and practice are important in the learning process to meet the objective of all true learning which is: to effect behavioral changes.

The experience requirements should be documented by a logbook or reliable witnesses. The instructor or observer should be convinced that the minimum requirements are met or he/she must require further proof.

Airmanship

The instructor or observer should be convinced that the student or pilot has the ability to take care of his own and others' safety at the applicable stage, within applicable rules, regulations, recommended safety limitations and code of good practice.

SAFE PRO, STAGE 1, GROUND SKIMMING, YELLOW.

Ground skimming is gliding near the ground over smooth terrain, normally not above 5 meters.

INSTRUCTIONAL AND SAFETY RECOMMENDATIONS:

The objective of this stage is to introduce the student to hang gliding and make him able to practice and enjoy ground skimming within safe limitations, as well as to prepare him for the next stage.

This stage is probably the most important in the whole progression of the student, since it is here the basis for good (or bad) habits is founded. One shall in safe closeness to the ground, fly easy equipment, in easy hills and conditions, to gain confidence in flying, the equipment and also one's self and practice and learn the basic skills.

It is warned against: Attempts to takeoff and fly in unstable conditions, cross, down, strong or gusty wind. One should not practice slow flight and stalls (except for the landings) or more than gentle turns with only small diversions from the flight path. To try to work any type of lift can be especially dangerous. The reason for these warnings is the closeness to the ground that gives little time or altitude for corrections. One should also avoid flying alone.

After all rating requirements have been met: The student should, when flying without the direct supervision of the instructor only fly in beginner hills in stable conditions with light and smooth headwinds.

A beginner hill is a hill with smooth terrain, preferably snow, sand, grass or gravel, with a profile that allow for ground skimming with the type of hang glider in use. The takeoff and landing areas and the area between should be free of obstacles and other hazards with a good margin to either side. It should be possible to do the whole flight in close to a straight line.

Before progressing to the next stage it is of vital importance that the student know the theory as well as mastering all the practical skills since weaknesses here may lead to the most serious consequences when he gets higher and flies in more difficult conditions. He must be competent in preparations before flight, good takeoff techniques, speed and directional control, and landings. It is especially important that he demonstrate correct procedures, routines and checks during his preparations to ensure that nothing is forgotten, overseen, wrongly assembled or adjusted. Equipment failures or malfunctions or failures to hook in are best avoided by developing proper habits from the very beginning.

To gain a minimum of experience the student is recommended to practice a minimum of 4 flying days and 20 flights, after all the rating requirements are met.

SAFE PRO Stage 1, KNOWLEDGE Requirements:

Aerodynamics:

1. Lift: Difference in pressure created by: Profile, airspeed and angle of attack. Low pressure under the wing, high pressure over the wing. Definition of: Relative wind, Even (laminar) airflow.
2. Resistance: Increasing with airspeed and angle of attack.
3. Driving forces:
 - a. On the ground: By running.
 - b. In the air: The principle of the inclined plane: Weight (thrust) and gravity.
4. Airspeed versus Ground speed: Why to take off and land into the wind.
5. Stalls: Description, dangers, recognition, avoidance and recovery.
6. Control movements and principles: Weight shift, banking and turning, airspeed control.
7. Wing tip vortices: Turbulence behind all aircraft, ground effect.
8. Airspeeds: Best glide angle and minimum sink.

Micrometeorology (site conditions):

1. Wind, description and creation: Airflow from high to low pressure. Created by uneven heating of the surface, etc. (Samples: Water flow. The sea breeze).
2. Wind measurement, wind meters, natural indicators and signs.
 - a. Velocity: Knots, MPH, km/h or m/s.
 - b. Directions: Compass and quadrant (Head or up, tail or down, crosswind).
3. The wind force: Increases with the square of the wind velocity increase. Effects, dangers.
4. Wind gradient: Effect, dangers, corrections.

5. Uneven wind/gusts, turbulence and lift: Causes, signs, dangers.
 - a. Mechanical: Behind or lee of obstructions, trees, buildings, hills.
 - b. Thermal: Instability, uneven heating, dangers, recognition.
 - c. Wind shifts: Gusts and dangers.
6. Recognition: of Safe and dangerous conditions.

Hang gliders and equipment:

1. Construction and Terminology: Materials and parts.
2. Airworthiness standards: Design and certification, purpose and need.
3. Maintenance: Daily and periodical inspection and care, qualified tuning and repairs.
4. Selection of gliders: Rating and experience, type of flying, performance, handling and weight range. Use and ambitions.
5. Selection of harnesses: Types of harnesses. Rating and experience.
6. Safety equipment: Helmet, boots, gloves, clothing, rescue system, wheels and nose skids.

Airmen:

1. Physical factors: Fitness, strength, exhaustion. Drugs and alcohol.
2. Psychological factors: Interest, motivations, anxiety, fears, pressure and self discipline.
3. The learning process and environment: The training system, objectives, description, safety, motivation, individual progress.

Rules and regulations (as applicable):

1. Government or other official authorities.
2. National Hang Gliding Association.
3. School and training.
4. Local and site(s).
5. Code of good practice.

Practical flying and safety:

1. Instructional and safety recommendations.
2. Flight planning: The process of flying: Information/observation, evaluation, decisions and execution. Making a flight plan.
3. Preparations: Standard routines and checks, double checks of critical factors.
4. Flying exercises: The practical skill requirements: Description, intention, procedures, execution, errors and dangers.
5. Critical, dangerous and emergency situations: Their causes, avoidance, recognition, corrections. Applicable training methods (simulations).
 - a. Poor preparation: Equipment failures and malfunctions. Failure to hook in.
 - b. Ground handling in gusts and strong winds: Loss of control.
 - c. Stalls: In level flight, in turns, low, high, in takeoff, in gradient, in gust, in lift, downwind.
 - d. Poor takeoff techniques: Poor airspeed and directional control. Stalls, loss of control, wing drop and turn back to hill.
 - e. Wind conditions: Wind strength, crosswind, gusts and turbulence, unexpected lift, drift into hill.
 - f. Crashing: Avoidance.
 - g. Accidents: Assistance and reports.

First Aid:

In accordance with appropriate authority's recommendations.

SAFE PRO Stage 1, PRACTICAL SKILLS, Requirements:

1. Transport, care and maintenance: of hang glider and equipment.
2. Pre and post flight routines: assembly, adjustment, preflight checks, disassembly.
3. Ground handling: Moving and parking hang glider.
4. Running with glider: Controlling angle of attack and roll, on flat ground and in slope.
5. Stalling and stopping a run: without nosing in, on flat ground and in slope. Correct landing technique.
6. Flight planning: Evaluating site and conditions. Decisions, giving a flight plan.

7. Takeoff position and final check: Correct nose attitude and wings level. Final check.: Of karabiner, conditions, clear area.
8. Takeoff: Smooth acceleration and lift off, with correct airspeed and good directional control.
9. Speed control: Best angle speed, no tendency of slow flight or stall.
10. Directional control: Maintaining heading, smooth course corrections.
11. Shallow turns: Coordinated entry and recovery, small diversions from course.
12. Landings: Directly into wind.

SAFE PRO Stage 1, EXPERIENCE Requirements:

1. A minimum of 4 flying days.
2. A minimum of 20 successful flights.

SAFE PRO Stage 1, AIRMANSHIP Requirements:

The instructor should be convinced that the student are able to take care of his own and others' safety while ground skimming, without direct supervision, within the instructional and safety recommendations given.

SAFE PRO, STAGE 2, ALTITUDE GLIDING (ORANGE).

Altitude gliding is gliding with enough height and distance from the terrain to be able to manoeuvre relatively freely.

INSTRUCTIONAL AND SAFETY RECOMMENDATIONS:

The objective of this stage is to introduce the student to gliding with height and distance to the terrain and make him able to practice and enjoy this within safe limitations, as well as to prepare him for the next stage.

At this stage, the student gradually becomes accustomed to flying well clear of the ground, and will lose possible height anxiety (allow for individual progression). One finds that one is actually safer in with altitude with time and space to manoeuvre and correct for possible mistakes.

One must now plan and prepare for each flight. One learns and practices the basic maneuvers, such as speed control including slow flying, coordinated turns, and combinations of those, light stalls, straight ahead and in turns, correction for wind drift and precision approaches and landings. The latter proves that one has mastered the other maneuvers with sufficient planning and precision. The key word is planning that starts even before takeoff and continues all the time. One must be ahead of the events, observe, evaluate, decide and act accordingly. This process of flying is vital in all aviation, also on the higher stages.

It is warned against attempts to take off in cross-, down-, gusty or strong winds and to fly in unstable or turbulent conditions or in lift. Poor planning, preparations and takeoff techniques may result equipment failures or malfunctions or failure to hook in, which may have the most serious consequences.

All maneuvers should be done into the wind to avoid drifting into the hill or too far off and hence not be able to reach the landing area. Advanced maneuvers, like 360° turns, pylon flying, stalls and slow flying should be performed with extra caution and sufficient height and distance to the terrain to allow for corrections or recovery if control is lost. Turns, downwind flying and airspeed below speed for best glide angle close to the ground should be avoided. Approach should be planned in good time, and started with good height. One should also avoid flying alone.

After all rating requirements have been met: The student should, when flying without the direct supervision of an instructor, only fly in beginner or intermediate hills with light to moderate (0-5 m/s, 0-20 km/h, 0-10 mph), smooth winds. Takeoffs should only be done in approximately headwind. Lift or turbulence should be avoided, or if

this is not possible, flown straight through (away from the hill) to calmer conditions in order to land in the ordinary landing area.

An intermediate hill is one where takeoff, landing area and the flight path between them is considered to be easy and with good margins to any obstacle or other safety hazards. The takeoff area should be smooth with a profile that allows for acceleration to flying speed before getting airborne (no cliff launch). The landing area should be large and easy to reach by normal maneuvering with a good margin of height. There should be established two-way communication between takeoff and landing if the landing area cannot be seen from takeoff.

Before progressing to the next stage it is of vital importance that the student master airspeed control in the lower speed range and is able to recognize and correct for stalls. This applies to both straight flight and turns.

To gain a minimum of experience, the student is recommended to practice a minimum of 4 flying days and 20 flights, after all rating requirements are met.

SAFE PRO Stage 2, KNOWLEDGE Requirements:

Aerodynamics:

1. Repetition of stage 1.
2. Lift factors: airfoils (wing profile), area, aspect ratio, air density, airspeed, angle of attack.
3. The nature of flying: One is always dependent on continuous forward airspeed in order to keep flying, one can not stop or reverse.
4. Principle of the inclined plane: In flying without engine one is always going down (related to the air around you) because gravity is the driving force.
5. Drag: Parasitic, induced, relation to airspeed and angle of attack.
6. Load: Weight, G-force. Forces in turns, pull-outs, lift gradients, gusts and turbulence.
7. Stalls: In turns, accelerated, secondary, in wind and lift gradients, downwind, in gusts and turbulence.
8. Spins, Spirals, Skids and Slips.
9. Speed polars: Minimum sink and best glide angle, relation between airspeeds in head and tailwind and varied wing loading.

10. Wind effects: Airspeed versus groundspeed, head- or tail-wind, wind drift and crabbing, drift and corrections in turns.

Meteorology

1. Repetition of stage 1.
2. Weather: Creation, heat and pressure differences stability/instability, circulation, wind systems.
3. Sea breeze: Creation, effects.
4. Local conditions: Terrain effects, valleys, around obstructions and corners.
5. Waves: Rotors. Behind mountains, signs and dangers.
6. Ridge effects: Descriptions, kinds, gradients, dangers.
7. Thermals: Description, instability, turbulence, signs.
8. Wind shears: Descriptions, dangers.
9. Clouds: Cumulus, cumulonimbus, rotor clouds, dangers.
10. Airmasses and Fronts: Cold fronts, warm fronts, signs and conditions.
11. Weather reports and evaluation:
 - a. Weather reports: Signs, interpretation.
 - b. Reading wind: direction and force, at takeoff and landing, along the flight path, indicators.
 - c. Recognition of safe and dangerous conditions.

Hang gliders and equipment:

1. Repetition of stage 1.
2. Airworthiness requirements: Design maximum loads, maneuvering limitations, stability, stall characteristics, maneuverability, speed range, pilot weight and rating.
3. Performance: Minimum sink, maximum glide, maximum speed, penetration, turning capacity.
4. Handling: Control response. Roll, pitch and yaw coupling. Stability, slow flight and stalls, takeoff and landing characteristics.

5. Maintenance: Daily and periodical inspections and care, qualified tuning and repairs, inspection after repairs.

Airmen:

1. Repetition of stage 1.
2. Psychological factors: Anxiety and fear of height. Recognition of own ability and limitations versus natural and equipment limitations. Confidence versus overconfidence (Icarus-syndrome). Group and personal pressures and approval, saying no, the walk down. Self discipline.
3. Conduct/ Airmanship:
 - a. The nature of flying: One is always dependent on continuous forward airspeed in order to keep flying, one can not stop or reverse.
 - b. The process of flying: Insight, continuous evaluations, decisions, actions. With regard to the nature of flying, being ahead.
 - c. The commando principle: The necessity of completing every started flight. The danger of panic.
4. Physical factors: Vertigo, hyperventilation.

Rules and regulations (as applicable)

1. Repetitions and more on stage 1.
2. National Hang Gliding Association.
3. School and training.
4. Local and Site(s).
5. Code for good practice.
6. Right of way rules.
7. Airspace and Air traffic: Controlled and uncontrolled airspace and airports, VFR/IFR traffic and rules, right of way rules.

Practical flying and safety

1. Repetition of stage 1.
2. Instructional and safety recommendations.

3. Flight planning/observations
4. Preparations: Standard routines and checks, double checks of critical factors.
5. Flying exercises: The Practical skill requirements: Description, intention, procedures, execution, errors and dangers.
6. Critical, dangerous and emergency situations: Their causes, avoidance, recognition, corrections. Applicable training methods (simulations).
 - a. Poor preparation: Equipment failures and malfunctions. Failure to hook in. Double hang-loop.
 - b. Poor takeoff techniques: Poor airspeed and directional control, stalls and loss of control, wingdrop and turn back into hill. Getting into harnesses.
 - c. Stalls: In gusts, turbulence, unexpected lift, in turns, downwind turns in gradient, in gradient, downwind.
 - d. Conditions: Strong winds, gusts, turbulence, wind gradient.
 - e. Critical maneuvers: Flying close to terrain and obstructions, stalls and slow flight, 360^o turns, pylon flying.
 - f. Unfamiliarity: With sites, conditions, glider or harness, maneuvers or tasks.
 - g. Physical and Physiological factors: Stress, pressure, exhaustion, fear, drugs and alcohol.
 - h. Poor airmanship: Overestimating own ability and/or underestimating sites, conditions, equipment or task.
 - i. Vertigo: Flying with reduced visibility.
 - j. Combinations: Of two or more of the above multiplies the risk of accidents.
 - k. Emergency maneuvers: Use of parachutes, landings in water, trees, rough terrain, obstructed areas, electrical wires.
 - l. Accidents: Assistance and reports.

First Aid:

In accordance with appropriate authority's recommendations.

SAFE PRO Stage 2, PRACTICAL SKILLS Requirements:

1. Review Stage 1 maneuvers mastered.
2. Planning: Insight, evaluations and decisions, making a flight plan.
3. Preparations: Assembly, adjustments, preflight checks.
4. Ground handling: Moving and parking hang glider.
5. Takeoffs: Start position, final check, even acceleration, lift off at correct speed, good speed and directional control.

6. Speed control maneuvers: Trim, best glide angle and minimum sink speed.
7. Turns: 90^o - 180^o, gentle to medium bank, left and right, coordinated.
8. Stalls: Gentle, straight ahead and in turns, correct entry, recognition and recovery (at safe altitudes).
9. Ground reference maneuvers: S-turns and rectangular patterns, correcting for wind-drift.
10. Traffic rules: Maneuvering according to other traffic.
11. Landing patterns: Following planned procedure. Approach with downwind, base and final legs. S-turns. Control of gradient.
12. Precision approaches and landings: Safe and standing inside an area preset by the instructor. Slow flight and mushing is not allowed.

SAFE PRO Stage 2, EXPERIENCE Requirements:

1. A minimum of 8 flying days.
2. A minimum of 40 successful flight.

SAFE PRO Stage 2, AIRMANSHIP Requirements:

The instructor should be convinced that the student are able to take care of his own and others` safety, while flying at stage 2, altitude gliding within the recommendations given.

SAFE PRO, STAGE 3, BASIC SOARING, GREEN.

Basic soaring is soaring in easy ridge or thermal conditions, without gusts or turbulence, well clear of the terrain, obstacles and other traffic.

INSTRUCTIONAL AND SAFETY RECOMMENDATIONS

The objective of this stage is to introduce the student to soaring flight and to make him able to practice and enjoy soaring within safe limitations. He should also be qualified to become a pilot, with the ability to operate alone within safe limitations and to take the responsibility for his further progression.

Soaring has many stages in itself, with increasing difficulty, from easy conditions and maneuvers with a large safety margin, to marginal or extreme conditions with minimal margins. When a pilot "masters the art", it seems quite simple and in a sense it is. This however, should not mislead anyone into believing that it is easily mastered. Lack of knowledge, misjudgment, wrong maneuvering, ignorance or gambling may easily end up in a serious accident.

One will on this stage get more time to practice in the air and the flying can get automated. There is however less room for mistakes and errors. Carefully planned progression is therefore very important. Exercises should in the beginning be simple and with large margins. Soaring requires careful preparation, good planning and ability to do precise and fast maneuvering. Especially important is good launch technique and control in the lower part of the speed range. One must be able to fly coordinated turns with a minimum loss of altitude, often in marginal conditions close to the ridge while calculating drift and keeping constant lookout for other traffic and maneuvering according to traffic rules. One must also be able to recognize all kinds of stalls and to execute prompt and correct recovery at the first signs, with a minimum loss of height and control.

To become a pilot: One should now also be free in order to develop further, and one has still a lot to learn in order to be able to use the possibilities there are. One will be given possibilities that will demand very good "airmanship" including self discipline and carefulness. It can often be necessary not to fly or to fly with large margins. The point is that one must show that one is able to take the responsibility and know where one's own as well as others' limits are, and when further instructions are necessary.

An instructor will no longer be responsible. This puts large demands on one's personality.

It is warned against too fast progression, overconfidence, inattention, ignorance, gambling, misjudgment and lack of skills. One will operate in stronger winds with smaller margins than on previous stages. Already during ground maneuvers accidents can happen. Poor techniques or distractions that may lead to loss of airspeed and/or directional control when launching can result in a turn back into the ridge. For example, when getting into flying position in a stirrup or cocoon harness. To avoid ground loops, one should have qualified assistance when moving the glider on the ground and when launching in strong or gusty winds. Further, one should be very careful with the conditions. Strong wind and turbulence may easily lead one to the lee side, or to drift in over dangerous/ unknown terrain. One should also avoid flying alone.

It is also warned against the so called "intermediate syndrome" or "Icarus syndrome", meaning that it is easy to believe that one now knows and masters everything, and that neither one's self or the equipment has limitations. (It is well known that Icarus was the first who killed himself because of this attitude.)

The student should only fly: with instructor present, in easy smooth conditions with a wide lift band or in smooth thermal conditions. This will allow him to manoeuvre with a good margin to other traffic and the terrain. He should be careful not to turn before he is established in flying position with good control of airspeed and direction. He should not try to return to a lift band he has flown out of. Ridge soaring in marginal lift, in strong wind (above 8 m/s, 30 km/h, 20 mph), in turbulence, cliff launches, crosswind launches, top landings or landings into the hill (hillside landings) are also not allowed.

After all rating requirements have been met one can fly freely as long as this is within safety limitations, and a higher stage is not required by other rules or regulation. One will have the responsibility to seek further instruction when necessary. It is recommended in the beginning to use the rules for students above as a guidance for safe flying.

Only experienced pilots should fly at advanced sites close to the ridge, in marginal, strong or turbulent conditions or in "heavy traffic".

Before progressing to higher stages, the pilot should have a variety of experience from different sites and conditions. The process of flying should be automated, so that reactions are fast and correct in the different situations/exercises one has to master. It is recommended to fly a minimum of 10 hours and 20 flights.

SAFE PRO Stage 3, KNOWLEDGE Requirements:

Aerodynamics:

1. Repetition of stage 1 & 2 theory.

2. Stalls: In takeoff, in gusts and turbulence. In lift gradients. Turning in lift gradients. In wind gradient. Turning in wind gradient (downwind). Secondary stalls.
3. Speed polars: Performance. Evaluation of glide angle and minimum sink with corresponding airspeeds: In head and tailwind, in lift and sink. With regards to wing loading, air density, turns.
4. Wind effects: Wind-drift and crabbing, drift and corrections in turns. Head- or tailwind, penetration.
5. Wing tip vortices: Behind other gliders, airplanes, helicopters.

Meteorology:

1. Repetition of stage 1 & 2 theory.
2. The wind force: Increases with the square of the wind velocity increase. Effects and dangers. On the ground, at takeoff, in the air, at the landing.
3. Ridge lift:
 - a. Factors: Shape and gradient of slope, wind direction and velocity.
 - b. Components: Horizontal and vertical, gradients, acceleration, strongest lift, strongest headwind.
 - c. Dangerous conditions and areas: Lee-side, turbulence, rotors, strong gradients and winds.
 - d. Safe and good conditions: Up and in front of the ridge.
4. Waves:
 - a. Factors: Terrain, wind direction and velocity.
 - b. Signs: High winds, lenticular clouds, rotor clouds.
 - c. Dangers: Rotors, penetration, strong lift, high altitudes, hypoxia, cold.
5. Thermals:
 - a. Factors: Instability, lapse rates, terrain, sunshine and heating.
 - b. Signs: Large temperature drop with altitude, wind shifts, lulls and gusts, cumulus clouds.
 - c. Dangers: Gusts and turbulence, strong lift gradients, pitch ups and downs.
 - d. Safe and good conditions: Large thermals, smooth and moderate gradient, light to medium winds.

6. Frontal lift: Cold front description.
 - a. Factors: Airmasses, from high to low pressures, instability.
 - b. Signs: Cumulus clouds, moving clouds, squall lines, wind-shift, temperature rise/fall.
 - c. Dangers: High winds, wind shift and gusts, strong lift, turbulence.
7. Clouds: Cumulus, cumulonimbus, cap clouds, rotor clouds, stratus clouds, lenticular clouds.
8. Weather reports: Actuals (METAR), forecasts (TAF), maps. Where to obtain, interpretations.
9. Weather signs: Reading the weather on the ground and in the air:
 - a. Measuring: Of the wind, pressure and stability.
 - b. Clouds: Associated weather and conditions.
 - c. Wind: Reading the wind, wind indicators.

Hang gliders and equipment:

1. Repetition of stage 1 & 2 theory.
2. Design Factors: Airworthiness, performance, handling.
3. Maintenance: Daily and periodical inspections and care, repairs.
4. Tuning: For maximum performance in the prevailing conditions.
5. Instruments: Variometers, altimeters, airspeed indicators.
6. Clothes and equipment: For endurance, high altitude and cold.

Airmen:

1. Repetition of stage 1 & 2 theory.
2. Pilot in command: Airmanship, traits, abilities, responsibilities, command and control. Mastering the nature and process of flying.
3. Physical factors: Vertigo, hypoxia, cold, exhaustion.

Rules and regulations:

1. Repetition of stage 1 & 2 theory.
2. The airspace and other traffic in the air:
 - a. Controlled airspace and airports: Control zones, terminal areas, airways, ATC, VFR/IFR traffic patterns, rules of operation, VFR rules for minimum visibility and distances from clouds.
 - b. Uncontrolled airspace and airports: Information zones and services, VFR/IFR traffic patterns, rules of operation, VFR rules for minimum visibility and distances from clouds.
 - c. Other airspace: Restricted, dangerous and prohibited areas.
3. Information sources: ICAO maps, publications, manuals, NOTAMs. Where to obtain. Air Traffic Control, information service, local airports and clubs, schools.
4. Right of way rules for hang and paragliders: General, ridge soaring, thermal soaring.
5. Other rules and regulations, as applicable: Government, National Hang Gliding Association.
6. Code of good practice.

Practical flying and safety:

1. Repetition of stage 1 & 2 theory.
2. Instructional and safety recommendations.
3. Preparations: Standard routines and checks, double checks of critical factors.
4. Flying exercises: The practical skill requirements: Description, intention, procedures, execution, errors and dangers.
5. Critical, dangerous and emergency situations: Their causes, avoidance, recognition, corrections. Applicable training methods (simulations).
 - a. Ground handling in gusts and high winds: Ground loops.
 - b. Poor takeoff techniques: Wrong use of or wrong commands to assistants. Poor airspeed and directional control, stalls, loss of control, wing drop and turn back to ridge. Getting into harness.
 - c. Stalls: In gusts, turbulence, in lift gradient, close to the terrain, in turns.
 - d. Conditions: Marginal lift, strong winds, gusts, turbulence, rotors.
 - e. Unusual attitudes: Turbulence, aerobatics, flying close to clouds.

- f. Critical maneuvers: 360⁰ turns, returning to lift band, flying close to the terrain, top landings, hillside landings, stalling in turns. Stopping a spin.
- g. Unfamiliarity: With sites, conditions, glider or harness, maneuvers or tasks.
- h. Physical and Physiological factors: Stress, pressure, exhaustion, fear, drugs and alcohol.
- i. Poor airmanship: Overestimating own ability, and/or underestimating sites and conditions.
- j. Vertigo: Flying with reduced visibility.
- k. Combinations: Of two or more of the above multiplies the risk of accidents.
- l. Emergency maneuvers: Use of parachutes. Landings in water, trees, rough terrain, obstructed areas, electrical wires.
- m. Accidents: Assistance and reports.

First Aid:

In accordance with appropriate authority's recommendations.

SAFE PRO Stage 3, PRACTICAL SKILLS Requirements:

1. Review: Stage 2 maneuvers mastered.
2. Planning: Evaluations and decisions, giving a flight plan.
3. Preparations: Assembly, adjustments, preflight checks.
4. Ground handling: Moving and parking glider in wind and gusts.
5. Takeoffs in wind: With assistance, procedures, instructions, start position. Final checks. Airspeed and directional control. Flying position.
6. Minimum sink maneuvers: Speed control, coordinated turns left and right, minimum loss of height, without any sign of stall.
7. Wind corrections exercises/ Maneuvering in lift bands: Figure 8 maneuvering, corrections for wind drift, turns and reversing direction. Maneuvering according to terrain and other traffic, keeping a good lookout.
8. 360 degree turns: Ordinary speed and on minimum sink, right and left, shallow to medium bank, without any sign of stalls. (Safe height and distance to terrain.)
9. Stalling: From minimum sink speed, from flight straight ahead and in turns, right and left. (Safe altitude and distance.)
10. Soaring: Entering, turning and maneuvering in lift, corrections and gradient, without any signs of stalls.

11. Precision approaches and landings: Safe and inside an area decided by the instructor.

SAFE PRO Stage 3, EXPERIENCE Requirements:

1. A minimum of 60 successful flights and a total of 10 flying hours.
2. Flights from 5 different sites, of which at least 3 are inland.
3. 3 flights and a total of 1 hour of flying in lift.

SAFE PRO Stage 3, AIRMANSHIP Requirements:

The instructor should be convinced that the student is able to take care of his own and others' safety within applicable rules and regulations, recommendations and code of good practice, while operating alone.

SAFE PRO, STAGE 4, ADVANCED SOARING, BLUE.

Advanced soaring is flying in demanding lift, such as marginal, strong and/or turbulent ridge, thermal or wave conditions.

INSTRUCTIONAL AND SAFETY RECOMMENDATIONS:

The objective of this stage is to make sure the pilot safely can fly advanced soaring, also under pressure as in displays, demonstrations and competitions.

This stage has turbulence and small margins as key words. One must be prepared to be forced to operate close to the safe operating limitations for the both the equipment and one's self. Even while one certainly should give both equipment and one's self good safety margins, one must be prepared for the possibility that those margins may be passed. A thorough knowledge of emergency procedures, such as recovery from stalls, spins, spirals, sideslips and unusual attitudes (i.e. upside down), as well as use of parachute, is very important. One must have a thorough knowledge of performance curves and correct flying speeds (speed polars), design limitations and load factors.

Advanced soaring requires the ability of fast and accurate evaluations of conditions and situations combined with fast and precise maneuvering. There will be situations with little time for balanced decisions and wrong reactions. One must be prepared by careful planning as well as one always must be ahead of the situation, so that one in critical situations gives the right reaction without spill of time. One must have highly developed skills and a thorough knowledge in order to gain maximum performance. One must, often close to the terrain and in turbulent conditions master all types of turns combined with low speeds, and also keep a close watch of terrain and other traffic.

It is warned against radical conditions, because of the enormous forces that may be present. Regardless of pilot skill and experience one may easily lose control and/or get structural failures. One must never overestimate one's self or the equipment. If one meets strong turbulence, don't panic and try to avoid it by sharp turns or high speeds, since this actually increases the possibilities for structural failures or loose of control. Correct maneuvering in strong turbulence is actually slow speeds and flight straight ahead or shallow banks if necessary. An other danger is stalling and lose control close to the terrain. If this happens, the right reactions is vital. This is first reduce angle of attack, then wait for speed to manoeuvre and then avoid collision. One should also avoid flying alone.

Students are under no circumstances allowed to fly advanced soaring.

Pilots must have a licence for this stage in order to fly advanced soaring in displays, demonstrations or competitions or else where this stage is required.

Before progressing to the next stage one must be able to, with a great deal of accuracy, evaluate conditions to be acceptable in relation to safety. One should also show that one can find and use all kinds of lift.

SAFE PRO Stage 4, KNOWLEDGE Requirements:

Repetition and more on topics from previous stages, especially:

Aerodynamics:

1. G-loads:
 - a. Versus maneuvering and speed in turbulence, turns and pulling out of dives.
 - b. Correct maneuvering speeds in turbulence. Stability. Speed polars.

Meteorology:

1. Thermals:
 - a. When, how and where. Stability versus instability in the air. Lapse rate.
 - b. Best thermal areas. Time of day and of year.
 - c. Types of thermals, dangerous thermal conditions, dry thermals.
 - d. Signs: Clouds, cumulus, cumulonimbus. Squall lines.
2. Wave conditions: waves, turbulence, high altitudes.
3. Dangerous conditions: Strong wind. Clouds, cumulonimbus, severe turbulence.

Glider and equipment:

1. Structural limitations: loads, speeds, attitudes, aerobatics. Structural failures.
2. Stability: Pitch positive: reflex, profile, wing torsion, sail distribution versus centre of gravity.

SAFE PRO Stage 4, SKILL Requirements:

1. Stage 3 maneuvers, mastered, reviewed if necessary.

2. Planning: The process of flying, making a flight plan.
3. 360° turns, shallow to medium bank, left and right.
4. 360° turns, steep, maximum pitch, left and right.
5. 360° turns, at minimum sink (flat), left and right.
6. Stalls in 360° turns, left and right, recognition and recovery (safe altitude).
7. Ridge soaring: Launching and soaring.
8. Thermal soaring: Launching, locating, entering and climbing.
9. Marginal lift: Launching and soaring.
10. Gusts and turbulence: Launching and soaring.
11. Maneuvering according to the traffic rules.

SAFE PRO Stage 4, EXPERIENCE Requirements:

1. Same as for stage 3, easy soaring, plus:
2. A total of minimum 20 flying hours.
3. A total of minimum 2 hours of thermal soaring.
4. A total of minimum 2 hours of ridge soaring.

SAFE PRO Stage 4, AIRMANSHIP Requirements:

The pilot should be considered to be able to take care of his/her own and others safety while flying at this stage, also during displays, demonstrations and competitions and elsewhere this stage is required.

SAFE PRO, STAGE 5, CROSS COUNTRY (BROWN)

Cross Country flying is to use rising air currents (soaring) to fly away from (and maybe return to) the local flying site.

INSTRUCTIONAL AND SAFETY RECOMMENDATIONS:

The objective of this stage is to enable the pilot to fly cross country safely, also under pressure as in demonstrations, displays and competitions.

This stage has nearly unlimited possibilities, from short and easy flights, to really demanding long distance flights, where if conditions permit, the pilot's ability, as well as his/her determination, will set the limits. It is here that the pilot ability, that is, his knowledge, skill, experience and airmanship, is put to the ultimate test.

One must be able to plan, administer and perform each flight within safe limitations, while one must stress one's self and the equipment to the same limitations to be able to go really far. One must have a thorough knowledge of aerodynamics and meteorology as well as air traffic rules and the airspace. In accordance with the planned flight, and existing and possible conditions, one must choose correct equipment like clothes, aids and emergency equipment, as well as organizing necessary transport and pick up, radio communications and procedures for use in an emergency situation such as landing and getting injured in deserted and difficult terrain.

Cross country flying requires the ability to find all types of lift, as well as correct maneuvering in lift and sink areas. One must be able to judge the terrain and conditions so as not to land where it is prohibited or where one may add injuries to one's self or others or in areas that are remote. One must be able to very quickly to pick out the best landing fields if one has to go down, and if necessary set up a precision approach to a small landing field with a short field landing over possible barriers. This is because any type of injuries may have the most serious consequences.

It is warned against cross country flying into remote and deserted areas, over areas with no possibilities for emergency landings and over water. One must always make sure that someone knows where one intends to fly, and that a search is activated if found necessary. If there are any possibilities for a landing in remote and deserted areas one should bring an emergency pack according to the conditions.

Students are under no circumstance allowed to fly cross country.

Pilots must have a licence on this stage in order to fly cross country in displays, demonstrations or competitions or else where this stage is required.

SAFE PRO Stage 5, KNOWLEDGE Requirements:**Navigation:**

1. **Planning:** Collecting information on weather, terrain, sites, airspace, air traffic and hazards. Use of map and other publications, air traffic and weather-service.
2. **Weather-service:** Where and how to get weather-information.
3. **Interpreting weather-reports:** Present (METAR), warnings (TAF), area (IGA), maps.
4. **Interpreting weather:** Signs, recognition of acceptable and dangerous conditions.
5. **Airspace and air traffic:**
 - a. **Controlled airspace:** Air-corridors, terminal areas, control zones and airports.
 - b. **Uncontrolled airspace:** AFIs and other airfields. Dangers, restrictions and prohibited areas.
 - c. **Military traffic:** Training areas, photographing from the air.
 - d. **Governmental publications:** AIC, AIP, Notam, ICAO maps.
6. **Use of maps:**
 - a. **Planning of flights:** Dangerous/ deserted areas, alternative routs, landing areas, communication and retrieval.
7. **Equipment:** For altitude and low temperatures, emergency and first aid equipment, survival equipment, warning and communication equipment.
8. **Standard procedures:** Signals, retrieval.
9. **Emergency procedures:** Warning, search after missing pilots.

SAFE PRO Stage 5, PRACTICAL SKILLS Requirements:

1. **Review:** Maneuvers from previous stages mastered.
2. **Planning:** Evaluations and decisions, giving a flight plan.
3. **Soaring:** Search for and use of all kinds of lift. Flying in lift and sink, head- and tail-wind with correct speed.
4. **Cliff-launch in moderate wind.**
5. **Cliff-launch in strong wind:** With assistance.

7. Crosswind-launch: Wind maximum 45 degrees on launch direction. Crosswind-component less than 2 m/s, 7 km/h, 5 mph.
8. Out-landings: Precision approach to unknown landing area: Selection of landing field, control of speed and glide angle.

SAFE PRO Stage 5, EXPERIENCE Requirements:

Same as for stage 4, plus.

1. A total of 50 flying hours.
2. A total of 5 cross country flights in various lift (ridge soaring and flying along the same ridge, only, is not approved).

SAFE PRO Stage 5, AIRMANSHIP Requirements:

The pilot should be able to take care of his own and others safety during cross country flying, also during displays, demonstrations and competitions and else where this stage is required.

APPENDIX

Suggested visual markings for the SAFE PRO system:

The students/pilots should have visual markings that shows the stage they are at. The following are suggested:

1. **A HELMET BADGE**, with colour trim, matching the colour of the stage. The badges currently used in Norway are shown for each stage [not in this version of the document].
2. **A WINDSTREAMER / WIND INDICATOR**, made of thin dacron with the correct colour coding. It should be attached to the front flying wires so as to assist the pilot in determining wind direction. There have been several discussions in hang glider magazines about carrying such a marking in the kingpost. We believe, however, that it is easier to get pilots to adapt something they actually may have use for. The type used in Norway has the Norwegian HGA initials printed on it. This is to prevent people from making their own, which may be mistaken for an original issued by the association.