

*Fédération
Aéronautique
Internationale*



SAFEPRO DELTA
RECOMMENDED SAFETY PROFICIENCY STANDARDS FOR HANG GLIDING
2016 Edition

*Maison du Sport International
Av. de Rhodanie 54
CH-1007 Lausanne
(Switzerland)
Tél. +41 (0)21 345 10 70
Fax +41 (0)21 345 10 77
E-mail: sec@fai.org
Web: www.fai.org*

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Note

In all the following text, "he", "him", "airman" refer to both female and male students / pilots.

SafePro Delta

A Hang Gliding Safety and Training Program*

by Stein Arne Fossum - Raymond Caux

The history of hang gliding has been written in a few years, where new barriers have been broken virtually every day. It has developed into a full-blooded aviation activity, meaning it is no longer simple and easy to learn, potentially more dangerous for the "self-learners", while the opposite may be true for the ones receiving proper training.

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

Looking at the levels of flying already reached (limited to foot launch, no power) along the history of hang gliding, we see 5 distinct stages. The following program basically keeps the safePro* philosophy, putting these stages together in a training system.

5 stages of hang gliding

- 1 Ground Skimming** (Not flying higher than you would care to fall)
- 2 Altitude Gliding** (Altitude and space to do maneuvers, no soaring)
- 3 Basic Soaring** (Soaring in non turbulent conditions)
- 4 Advanced Soaring** (Soaring in turbulent conditions)
- 5 Cross Country**

Each stage is followed by a more complex one (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. There are other steps, such as changing to another harness, or learning to fly a new site or a new glider.

Additional stages like Aerobatics are considered as unsafe for the general pilots until now. They should therefore only be performed by specialists using a strict expert program, until safe methods are found to make them available to everyone.

To be very clear, there is no reason today to try to learn alone. All the previous experience would be useless and the chance of accident very high. Some accidents were unavoidable because of the pioneering nature of the sport (Lilienthal was the first one), while others could have been avoided simply by proper training.

Analysing why most accidents caused by "pilot error" happen, one finds that either the pilot tries to perform a task or meet a condition he is not able to master, or he simply does

* Note: This text was originally written by Stein Arne Fossum in the SAFE PRO system in 1980-1982, updated and completed by Raymond Caux in 2013 to suit different methods of instruction (slope, towing).

something that should not be done. Seeing the hang glider plus its equipment like an aircraft as a whole can also help against classical errors like forgetting to hook in.

Today we have enough knowledge to avoid most of such accidents, either collected by the hang gliding community itself or available through other air sports. We know how a task should be performed correctly or what are the limitations not to exceed (any motor or glider pilot knows cloud flying is dangerous, and it is hence unnecessary to rediscover it).

Accidents are also 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. These steps are filled with instruction.

Pilot's Ability in hang gliding: It can be broken down to **4 Qualities**:

- **Knowledge**
- **Skills**
- **Experience**
- **Airmanship**

Knowledge and **Experience** are only "tools" used to improve a pilot's **Ability**. They are however of good value in the learning process and as such can hardly be overestimated. The pilot certainly also must show good **Airmanship**, which a good instructor is able to spot often before he is even in the air, but it is difficult to measure and diagram.

Skills can best measure a pilot's ability, since hang gliding is a practical activity. It means his way of performing maneuvers, links of maneuvers, tasks, and how he masters flying conditions and new situations.

Based on the above statements, the training system proposed here is built as a natural progression, mainly developing and measuring the pilot's **Skills**, although the other 3 qualities have found their place.

For instance, **Airmanship** is expressed by the pilot having:

- either a **Student Licence**, when he lacks the necessary airmanship. As such he is under a training system, controlled by an instructor and all his flying shall be in accordance with the instructor's guidelines;
- or a **Pilot Licence**, showing he is mature enough to take care of his own flying, seeking further instruction when needed. He does not "know it all", but merely can take care of himself at his current stage. When he wants to progress to a higher stage, he seeks instruction before going out on his own flying.

Colour Codes ("Black belt" in Hang Gliding): The stages are colour coded from yellow to brown for easy identification. The student can wear visible markings that identify him, as well as his stage. Apart from being a good site control system, it gives the students and pilots insight in what they are up to.

Note: A "black" or Master grade may be considered as the top level. This grade should express the ultimate in Knowledge, Skills, Experience and Airmanship.

SafePro Delta, general description

Objective: The program aids and assists the participants to progress safely and become true airmen. They must be able to enjoy the beauty and freedom of the sport, without risking injury or restrictions due to their own and others' lack of ability. The students need time to develop until they can operate alone within the objective above. This is developed most efficiently, enjoyably and safely through a motivating program. The students' operational freedom is expanded gradually, without jeopardizing safety, by breaking down the way into easily identifiable blocks attainable by most people.

Program: It consists of 5 natural stages, from the easy to the more difficult, from low to high, from basic to advanced, being careful not to leave any gap on the way. It also divides the participants into students and pilots, indicating whether they are autonomous or not. All previous stages will be reminded in the beginning of a new stage, for each chapter.

1	Ground skimming	Yellow	Student
2	Altitude gliding	Orange	Student
3	Ridge soaring	Green	Student
4	Thermal soaring	Blue	Pilot
5	Cross country	Brown	Pilot

Participants

Student: He is under training, and is considered to have limited ability to take care of his own and other people's safety. He is not yet able to evaluate all safety elements, make sound decisions and act accordingly without the supervision of an instructor.

Pilot: He can take care of his own and other people's safety within applicable rules, regulations and code of good practice. He can evaluate all safety elements, make safe and sound decisions and act accordingly on his own, or obtain further instruction, information and assistance at his own discretion.

Recommended limitations

Students shall always fly under supervision of an instructor, and before all ratings are reached, under direct supervision of an instructor. They shall use only hang gliders and harnesses suitable for them and on which they have been checked out by an instructor. Tuning and repairs shall be made only when approved by an instructor.

Pilots are expected to be familiar with and to follow all applicable national aeronautical regulations and local flying site rules. They shall not participate in demonstration, competition or other organised flying requiring higher standards than they are rated for.

Minimum age: The minimum recommended age is 14 years old, with a written permission of parent or guardian and a medical agreement* below 18 years.

* Note: based on minimum requirements (1,50 m / 4.90 ft, 45 kg / 99 lbs, no spine problem)

SafePro Delta, stage elements

Knowledge

Students stages 1, 2 & 3 shall be given the lectures, briefings, discussions and written tests to ensure the knowledge required at the current stage is acquired. The requirements should not restrict from giving more instruction, the pedagogy being left to the instructor. However one must not forget that especially beginners have limited capacity to "absorb" many advices, which should then be limited to those necessary for the very proposed task.

Before a student is signed off at a completed stage 3, he shall pass a written test on air law, applicable regulations and code of good practice, ensuring he has the necessary knowledge to operate alone, safely and correctly at sites and in the air.

Pilots stages 4 & 5 may at their own discretion acquire the required knowledge, either attending 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.

Skills

Students stages 1, 2 & 3 shall be given the necessary instruction in each practical skill, once the basic theory, aim, normal procedure, mistakes, dangers and their corrections, and safety aspects are known. Each skill shall be practiced until the instructor is convinced it is mastered. The skills may be signed off progressively as the criteria are met, hence a special flight test may not be necessary.

Pilots stages 4 & 5 may at their own discretion, within acceptable safe methods, acquire the necessary instruction for each skill. Before they are signed off, they shall be demonstrated to an instructor, who shall be convinced they are mastered.

Experience

Experience shall ensure that the knowledge, skills and airmanship have been practiced a minimum of times in various situations. Exercise, drill and practice are important to meet the objective of all true learning, which is to effect behavioral changes.

The experience requirements shall be documented by a logbook or reliable witnesses. The instructor or observer shall be convinced that the minimum requirements are met.

Airmanship

The instructor or observer shall be convinced 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.

SAFEPRO DELTA STAGE 1, GROUND SKIMMING (YELLOW)

Ground skimming is gliding near the ground over smooth terrain, normally below 5 meters.

Instructional and safety recommendations

Objective: This stage introduces the student to hang gliding and enables him to discover the first feelings of flying within safe limits, as well as it prepares him for the next stage.

This stage is probably the most important in the whole progression, since here is founded the basis for good (or bad) habits. The student shall, in safe closeness to the ground, fly easy equipment in easy environment and conditions, to gain confidence in flying, the equipment, also himself, and practice and learn the basic skills.

Methods: Teaching has been traditionally on training slopes. However, flying close to the ground asks for a precise control with few time to react and makes hang gliding among the most demanding airports. To start with the easiest, that is controlling a straight flying line before teaching to take off and land, alternative methods are available now, like static flying (on a driven platform or in the wind, with assistants or links holding the glider in a defined volume), winch towing with low tensions close to the ground, or aerotowing with a complete method including tandem first flights and an adapted release system. Only a couple of minutes of in-flight control, or even just displaying a film from an onboard camera can dramatically ease the student's first steps.

Proper environment: This is with smooth terrain, preferably snow, sand, grass or gravel, with a profile that allows for ground skimming with the type of hang glider in use. The takeoff and landing areas and the space between should be free of obstacles and other hazards with a good margin to any side. It should be possible to do the whole flight in close to a straight line.

It is warned against attempts to take off and fly in unstable conditions, cross, down, strong or gusty wind. The student shall 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 is the closeness to ground gives little time or altitude for corrections. He shall also avoid flying alone.

When all rating requirements have been met, the student shall, when flying without direct supervision of the instructor, only fly in beginner environment in stable conditions with light and smooth headwinds.

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

SafePro Delta Stage 1, Knowledge requirements

Human

- 1 **Physical factors:** Fitness and exhaustion, hydration, food, skin and eye protection, alcohol and drugs.
- 2 **Psychological factors:** Interest, motivation, fear of height, vertigo.

Aircraft

- 1 **Terminology:** Material and parts.
- 2 **Safe equipment:** Helmet, boots, gloves, clothing, wheels, nose skid.

Aerodynamics

- 1 **Nature of flying:** Always dependent on continuous forward airspeed.
- 2 **Driving forces**
 - a **On the ground:** By running.
 - b **In the air:** Weight (gravity).
- 3 **Lift:** Axes, difference in pressure from profile, airspeed, angle of attack.
- 4 **Airspeed, groundspeed:** Why take off and land into the wind.
- 5 **Control movements:** Weight shift, banking, turning, airspeed control.

Meteorology

- 1 **Wind:** Wind meters, natural indicators and signs.
 - a **Velocity:** m/s, km/h, knots or mph.
 - b **Direction:** Compass and quadrant (head or up, tail or down, crosswind).
 - c **Force:** Increases with the square of the wind velocity, effects, dangers.
- 2 **Conditions:** Recognition of safe and dangerous conditions.
- 3 **Turbulence, gusts**
 - a **Mechanical:** Behind or lee of obstructions, trees, buildings, hills.

Rules

- 1 **Insurance**
- 2 **School and training**
- 3 **Code of good practice**

Safety

- 1 **Preparation:** Standard routines and checks, double checks of critical factors (consider hang glider + harness as a complete aircraft).
- 2 **Exercises:** Description, intention, procedures, execution, errors and dangers.

SafePro Delta Stage 1, Skills requirements

- 1 **Transport, care:** Of hang glider and equipment.
- 2 **Equipment routines:** assembly (as much as equipment allows it, hook in harness before putting it on), adjustment, preflight checks, disassembly (as much as equipment allows it, remove harness before unhooking it).
- 3 **Ground handling:** Carrying, moving and parking hang glider.
- 4 **Final check:** Connection, conditions, visualising run or flight, glider attitude, clear area.
- 5 **Running, stopping a run:** On flat ground and in slope, using glider as a brake.
- 6 **Takeoff:** Sight forward, smooth acceleration, feeling glider lift off.
- 7 **Flight control:** Correct airspeed and directional control, smooth corrections.
- 8 **Landing:** Directly into wind, sight forward, using glider as a brake.

SafePro Delta Stage 1, Experience requirements

- 1 At least **3 practice days**.
- 2 At least **10 successful attempts**.

SafePro Delta Stage 1, Airmanship requirements

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

SAFEPRO DELTA 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

Objective: This stage introduces the student to gliding with height and distance to the terrain, enables him to enjoy flying within safe limits, and prepares him for the next stage.

At this stage, the student gradually becomes accustomed to flying well clear of the ground, and should lose possible height anxiety. He finds that he is actually safer in with altitude, time and space to manoeuvre and correct for possible mistakes.

Proper environment: The takeoff, landing area and the flight path between them are easy and with good margins to any obstacle or other hazards. The takeoff area shall be smooth and allowing for acceleration to flying speed before getting airborne (no cliff launch). The landing area shall be large and easy to reach by normal maneuvering with a good margin of height. There shall be an established two-way communication between takeoff and landing if the landing area cannot be seen from takeoff.

Planning is the key word. The student must now plan and prepare for each flight. He learns and practices the basic maneuvers, such as speed control, coordinated turns and combinations of them, light stalls, correction for wind drift and precision approaches and landings. The planning starts even before takeoff and continues all the time. He must be ahead of the events, observe, evaluate, decide and act accordingly, like in all aviation.

Drift and margins: All maneuvers shall be done into the wind to avoid drifting and hence not being able to reach the landing area. Advanced maneuvers like 360° turns, stalls and slow flying shall be performed with extra caution and sufficient height and distance to the terrain to allow for corrections or recovery upon loss of control. Turns, downwind flying and slow speeds close to the ground shall be strictly avoided. Approach shall be planned in good time and with good height. The student shall also avoid flying alone.

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, preparation and takeoff techniques may result in equipment failures or malfunctions, or failure to hook in, which may have the most serious consequences.

When all rating requirements have been met, he shall, when flying without the direct supervision of an instructor, only fly in beginner or intermediate environment with light to moderate (0-5 m/s, 0-20 km/h, 0-10 mph) smooth winds. Takeoffs shall only be done in approximately headwind. Lift or turbulence shall be avoided, or if not possible, flown straight through to calmer conditions in order to land in the ordinary landing area.

Before progressing to the next stage, it is of vital importance that the student know the applicable theory, master airspeed control in the lower speed range and be able to recognise and correct for stalls.

SafePro Delta Stage 2, Knowledge requirements

Human

- 1 **Learning process:** Description, objectives, individual progress, safety.
- 2 **Psychological factors:** Recognition of own ability, emotions management.
- 3 **Commando principle:** Necessity to complete any started flight.

Aircraft

- 1 **Glider handling:** Axes, roll and yaw coupling, trim, slow flight and stalls.
- 2 **Harness tuning:** Fixing harness position and comfort.
- 3 **Rescue system**

Aerodynamics

- 1 **Load:** Weight, G-force, in turns, pull-outs, lift gradients, gusts and turbulence.
- 2 **Drag:** Increasing with airspeed and angle of attack, parasitic, induced.
- 3 **Drift:** Head or tail wind, crabbing, corrections in turns, penetration.
- 4 **Stall:** Description, secondary, in wind and lift gradients, downwind, in turbulence and gusts, dangers, recognition, avoidance and recovery.

Meteorology

- 1 **Wind:** Airflow from high to low pressure (sample: water flow), Coriolis effect, at takeoff, in landing and along the flight path, indicators, gradient.
- 2 **Breezes:** Creation, sea, mountain, valley, strength, effects.
- 3 **Local conditions:** Terrain effects, valley, Venturi effect, obstructions, corners, rotors.
- 4 **Turbulence, gusts**
 - a **Wind shifts and shears:** Descriptions, dangers.

Rules

- 1 **Local and site(s)**
- 2 **Right of way rules:** crossing, slope, thermals, aircraft categories priorities.

Safety

- 1 **Flight planning:** Process, information, observation, evaluation, decision, execution.
- 2 **Flying exercises:** Description, aim, procedures, execution, errors and dangers.

SafePro Delta Stage 2, Skills requirements

- 1 **Planning:** Insight, evaluations and decisions, flight plan, axes, drift, height, marks.
- 2 **Final check**
- 3 **Takeoff:** Start position, even acceleration, correct speed, transition to lying position.
- 4 **Speed control:** Trim, minimum sink speed, best glide angle.
- 5 **Shallow turns:** Visual check, gentle to medium bank, coordinated, drift correction.
- 6 **Approach:** Setting relative to terrain and wind, types of approach, stand up and hands in piloting position, straight final, gradient prevention with speed.
- 7 **Landing:** Aiming towards a preset area, speed bleed off and feeling trim speed, hands in push out position, slow flight and mushing are not allowed.
- 8 **Ground handling:** Checking traffic, leaving landing for next pilots.

SafePro Delta Stage 2, Experience requirements

- 1 At least **6 practice days**.
- 2 At least **10 flights**.

SafePro Delta Stage 2, Airmanship requirements

The instructor shall be convinced that the student is able to take care of his own and others' safety, while altitude gliding within the recommendations given.

SAFEPRO DELTA 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

Objective: This stage introduces the student to soaring flight and makes him able to practice and enjoy soaring within safe limitations. He shall also become qualified as pilot, able to operate alone in a defined frame and be responsible for his further progression.

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

At this stage, the student gets more airtime and the flying can get automated, but there is less room for mistakes and errors. His experience is still low, any setback needs to be avoided. A carefully planned progression is therefore important. Exercises shall be simple in the beginning, with large margins. Soaring requires preparation and a good ability to do precise and fast maneuvers. The launch and lower speed range control must be mastered, like coordinated turns with a minimum height loss, often close to the ridge, while calculating drift, keeping an eye on traffic and respecting traffic rules. He is also be able to recognize all kinds of stalls and execute prompt and correct recovery.

Proper environment: It is basically the same as in stage 2, plus mild conditions with a good margin to other traffic and the terrain. In ridge soaring with a wide lift band, the student shall not return to the lift he has flown out of. Flying in strong wind (above 8 m/s, 30 km/h, 20 mph), turbulence, cliff or crosswind launches, top or into the hill landings are not allowed. In flatland, he shall fly in smooth thermals (late afternoon or overcast sky). An instructor should be present. At first, there shall still be a communication between an instructor and the student, but he shall become autonomous during this stage.

It is warned against too fast progression, overconfidence, inattention, ignorance, gambling, misjudgement and lack of skills. The "intermediate" or "Icarus syndrome" means believing he now knows and masters everything, and that neither himself or the equipment have limitations... He will operate in stronger winds with smaller margins. Already upon ground handling can accidents happen. He must ask for qualified assistance when moving the glider and launching in strong or gusty winds. Poor technique or distractions leading to loss of airspeed or directional control when launching, like getting into flying position in a stirrup or cocoon harness, can result in a turn back to the ridge. Strong wind and turbulence may easily lead him to the lee side, or let him drift over dangerous / unknown terrain. He shall still avoid flying alone.

When all rating requirements have been met, he can fly freely within safety limitations, and as long as a higher stage is not required by rules or regulation. He has 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.

Before progressing to higher stages, the pilot shall have a variety of experience from different sites and conditions. The process of flying shall be automated, so that reactions be fast and correct in the different situations / exercises he has to master.

SafePro Delta Stage 3, Knowledge requirements

Human

- 1 **Process of flying:** Insight, continuous evaluations, decisions, actions, being ahead.
- 2 **Pilot in command:** Responsibilities, abilities, command and control.

Aircraft

- 1 **Clothes:** For endurance, altitude and cold.
- 2 **Instruments:** Variometers, altimeters, airspeed indicators, tuning.
- 3 **Performance:** Minimum sink, maximum glide and speed, penetration, maneuverability.
- 4 **Maintenance:** Daily and periodical inspections and care, qualified tuning and repairs, inspection after repairs.

Aerodynamics

- 1 **Wing tip vortices:** Creation, behind aircraft, ground effect.
- 2 **Spin:** At takeoff, turning, turning downwind, spin recovery, wind gradient, in landing.
- 3 **Spiral, skid and slip**
- 4 **Design factors:** Airfoils, area, aspect ratio, taper, twist, dihedral, effects.

Meteorology

- 1 **Ridge lift**
 - a **Factors:** Shape and gradient of slope, wind direction and velocity.
 - b **Components:** Horizontal, vertical, gradients, acceleration.
 - c **Zones:** Strongest lift, strongest headwind, turbulence, lee, rotors.
- 2 **Thermals**
 - a **Factors:** Uneven heating, instability, lapse rates, contrasts, light to medium winds.
 - b **Types:** Radius, strength, dry thermals, dangers.
 - c **Signs:** Temperature drop with altitude, lulls and gusts, clouds, squall lines.

Rules

- 1 **National Hang Gliding Association**
- 2 **Government** or other official authorities
- 3 **VFR rules:** Minimum visibility and distances from clouds.

Critical situations

- 1 **Preparation:** Causes, recognition, avoidance, corrections, training (simulations).
- 2 **Poor takeoff:** Sight downward, poor glider attitude, brutal acceleration, poor contact with A-frame, wingdrop and turn back into hill, getting into harness.
- 3 **Stall:** In turbulence, unexpected lift, turns, gradient, downwind, dangers.

- 4 **Critical maneuvers:** Flying close to terrain and obstructions, slow flight, 360° turns.
- 5 **Poor approach and landing:** Unstructured, no clear plan, over landing field, low turns, slow flight close to terrain.

First aid

In accordance with appropriate authority's recommendations.

SafePro Delta Stage 3, Skills requirements

- 1 **Takeoff in wind:** Types, with assistance, instructions, start position.
- 2 **Turns:** Ordinary speed and on minimum sink, coordinated, no sign of stall.
- 3 **Maneuvering in lift band:** Figure 8 patterns, drift correction, reversing direction, maneuvering according to terrain and traffic, keeping a good lookout.
- 4 **Soaring:** Entering and maneuvering in lift, corrections and gradient, no sign of stall.
- 5 **Stall:** Straight ahead, in turns (safe distance to terrain), no whip stall, recovery.
- 6 **Precision approach and landing:** Safe and inside an area decided by the instructor.
- 7 **Landing in wind:** According to wind strength, traffic control, ground handling.

SafePro Delta Stage 3, Experience requirements

- 1 At least **30 successful flights**, from 3 different sites, of which 2 inland.
- 2 At least **7 flying hours**.

SafePro Delta Stage 3, Airmanship requirements

The instructor shall 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.

SAFEPRO DELTA STAGE 4, ADVANCED SOARING (BLUE)

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

Instructional and safety recommendations

Objective: This stage is to make sure the pilot can safely fly advanced soaring, also under pressure as in traffic, demonstrations and local competitions.

This stage has turbulence and small margins as key words. The pilot will operate close to the operating limitations for both the equipment and himself. Even while he certainly shall keep safety margins, they will become smaller. A thorough knowledge of emergency procedures, such as recovery from stalls, spins, spirals, sideslips or turbulence induced dives, of the use of parachute, is necessary. He knows the 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. The pilot plans carefully and is always well ahead of the situation, so that he give in critical situations the right reaction without spill of time. He has highly developed skills to gain maximum performance. He 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. He must never overestimate himself or the equipment. Meeting strong turbulence, he does not panic with high speeds, since this actually increases the possibilities for structural failures or loss of control. Correct maneuvering in strong turbulence is actually medium speeds and a firm grip on the control bar at chest (safety position). Another danger is stalling close to the terrain. The right reaction is vital, it is first reducing angle of attack, then wait for speed to manoeuvre and then avoid collision. He shall also avoid flying alone.

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

Pilots must have a licence for this stage in order to fly advanced soaring in displays, demonstrations, local competitions or else where this stage is required. **Students** are under no circumstances allowed to fly advanced soaring.

SafePro Delta Stage 4, Knowledge requirements

Human

- **Psychological factors:** Confidence / overconfidence, group or self pressure, approval, self discipline, ability to give up.

Aircraft

- 1 **Harness selection:** Rating, experience, types of harnesses.
- 2 **Harness tuning:** Comfort, organisation, water, radio, all wires inside harness.
- 3 **Glider selection:** Size, handling, experience, type of flying, ambitions, performance.
- 4 **Glider tuning:** For maximum performance in the prevailing conditions.

Aerodynamics

- 1 **Airspeeds:** Speed polar, minimum sink, best glide angle, influence of lift / sink, of head / tail wind, turns, wing loading, air density.
- 2 **Stability:** Positive pitch, reflex, wing torsion, sail distribution versus centre of gravity.
- 3 **G-loads:** Speed in turbulence, pulling out of dives, aerobatics, structural failures.
- 4 **Airworthiness:** Design and certification standards, purpose and need, load, weight, speed and maneuvering range, stability, stall characteristics, rating.

Meteorology

- 1 **Weather:** Heat and pressure differences, global circulation.
 - a **Airmasses, fronts:** Stability / instability, signs, convergence.
 - b **Measuring:** Wind, pressure, humidity and stability.
 - c **Clouds:** All types, associated weather and conditions.
 - d **Reports:** Actuals (METAR), warnings (TAF), area (IGA), maps, interpretation.
- 2 **Frontal lift:** Cold front description, thunderstorms.
 - a **Signs:** Towering clouds, squall lines, wind shift, temperature fall.
 - b **Dangers:** Cumulonimbus, high winds, gusts, strong lift, turbulence.

Rules

- 1 **Information sources:** ICAO maps, publications, AIC, AIP, manuals, NOTAMs, information service, local airports and clubs, schools.
- 2 **Controlled airspace:** Control zones, terminal areas, airways, Air Traffic Control VFR/IFR traffic patterns, rules of operation.
- 3 **Uncontrolled airspace:** Information zones and services, VFR/IFR traffic patterns, rules of operation.
- 4 **Other airspace:** Restricted, dangerous and prohibited areas.

Critical situations

- 1 **Unfamiliarity:** With site, equipment, maneuvers or tasks, priorities, conditions.
- 2 **Ground handling in high wind:** Ground loops, turning glider after landing.
- 3 **Reduced visibility:** Flying close to clouds, reactions.
- 4 **Critical maneuvers:** Returning to lift band, top landing, spin recovery.

- 5 **Accidents:** Assistance and reports.
- 6 **Poor airmanship:** Overestimating own ability, underestimating site, conditions, equipment or task.

SafePro Delta Stage 4, Skills requirements

- 1 **360° turns:** From minimum sink to steep bank, correcting drift.
- 2 **Ridge soaring:** Best lift zone, best speed along the ridge, managing priorities.
- 3 **Thermal soaring:** Finding and following thermal cores, choosing exit direction.
- 4 **Speed range:** Exploring medium speeds.

SafePro Delta Stage 4, Experience requirements

- 1 At least **20 flying hours**.
- 2 At least **one 2 hours thermal soaring flight**.

SafePro Delta Stage 4, Airmanship requirements

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

SAFEPRO DELTA 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

Objective: This stage enables 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 and his determination will set the limits. Here is the pilot's ability put to the ultimate test.

Cross country flying requires to plan, administer and perform each flight within safe limitations. The pilot has a thorough knowledge of aerodynamics, meteorology, traffic and airspace rules. In accordance with the planned flight, existing and possible conditions, he chooses correct equipment, organises retrieve, communication and procedures to use in an emergency situation. He is able to find all types of lift and fly at the correct speed. He can judge the terrain and conditions to avoid landing in prohibited or remote areas, or where he may cause injuries to himself or others. He can quickly choose the best landing field and set up a precision approach for a short field with possible barriers.

It is warned against cross country flying over areas with no possibilities for emergency landings and over water. He always makes sure that someone knows where he intends to fly, and that a search is activated if necessary. If there is any possibility for a landing in remote or deserted areas, he brings an emergency pack according to the conditions.

Pilots have a licence on this stage in order to fly cross country in displays, demonstrations or competitions or else where this stage is required. **Students** are under no circumstance allowed to fly cross country.

SafePro Delta Stage 5, Knowledge requirements

Human

- **Awareness:** Analysing, staying ahead, ability to give up, keeping energy for landing.

Aircraft

- 1 **Equipment:** GPS, emergency / first aid / survival equipment, oxygen, beacon.
- 2 **Maintenance:** Recognition of sail aging, tension tuning.

Aerodynamics

- **Gliding:** McCready theory, choosing thermal exit time and speed to fly.

Meteorology

- **Wave**
 - a **Signs:** Terrain, wind direction and velocity, stability, lenticular clouds.
 - b **Dangers:** Rotors, low penetration, strong lift, high altitudes, hypoxia, cold.

Planning

- 1 **Use of maps:** Airspace, deserted areas, hazards, landing areas, alternative routes.
- 2 **Procedures:** Signals, retrieval, warning, search after missing pilots.

Rules

- 1 **Controlled airspace:** Air corridors, terminal areas, control zones and airports.
- 2 **Uncontrolled airspace:** AFI, other airfields, dangers, restrictions, prohibited areas.
- 3 **Military traffic:** Training areas, photography from the air.

Critical situations

- 1 **Unusual attitudes:** Turbulence, pitch ups and downs, safety position.
- 2 **Critical maneuvers:** Hillside landing, use of parachute, landing in trees, rough terrain, water, obstructed areas, electrical wires, using glider to absorb energy.

SafePro Delta Stage 5, Skills requirements

- 1 **Special launches**
 - a **Crosswind:** Maximum 45°, side component less than 2 m/s, 7 km/h, 5 mph.
 - b **Cliff launch:** In moderate to strong wind, assistance.
 - c **Towing** (if possible): Winch and aerotowing.
- 2 **Speed range:** Exploring high speeds in smooth air.
- 3 **Turbulence, gusts:** Safety position.
- 4 **Out landings:** Selection of landing field, control of speed and glide angle, precision approach to unknown landing area, use of drogue chute.

SafePro Delta Stage 5, Experience requirements

- 1 At least **50 flying hours**.
- 2 At least **5 cross country flights** (flying lonely along the same ridge is not approved).

SafePro Delta Stage 5, Airmanship requirements

The pilot is able to take care of his own and others' safety in cross country flying, also during displays, demonstrations, competitions and wherever this stage is required.

APPENDIX

Suggested visual markings for the SafePro Delta system

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

- 1 Helmet badge:** With colour trim, matching the colour of the stage. The badges currently used in Norway are shown for each stage.
- 2 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. We believe it is easier to get pilots to adapt to something they actually may have use for (instead of windstreamer on the kingpost). The type used in Norway has the Norwegian HGA initials printed on it., to prevent people from making their own, which may be mistaken for an original issued by the association.