

PHYSICAL AND MENTAL TECHNIQUES OF RECOVERY :A SURVEY IN FRENCH ELITE SOARING PILOTS

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SUMMARY

The physical and mental techniques of recovery of French soaring pilots, during sustained contest or training sessions, have been investigated. The performance of soaring pilots seems to be often affected by the physiological and psychological stresses associated with sustained activity, fatigue and sleep loss. Our research reports describe decrements in sustained soaring performance, especially after one or several nights with sleep disturbances, in worsened decision time and control of fine movements, and perceptual and cognitive distortions.

The present survey took place during several soaring sessions in the French National Soaring Center of Saint Auban (CNFA), and involved a questionnaire. Thirty-

seven glider pilots took part: nineteen pilots (of thirty-one) were enrolled on the national list of high level pilots; seven were permanent coaches of the National Center (CNFA) and National High Level Center (CFHN) at Saint Auban; and eleven had at least five years cross-country experience (about 500 hours) during their soaring trainer qualification.

The high level pilots are generally more conscious of the importance of recovery than others. Most of them say that they do have habits to enhance the recovery of their aptitudes, defeated during long repeated sustained flights. Some of these habits are now tested in our laboratory and during simulated contest flights. Key words to note: Soaring, continuous work, sustained work, fatigue, recovery.

The aim of this paper is to present one of the several

inquiries conducted in our laboratory since 1989 within a large research program sustained by a grant of the French Defense Department (Convention n° 568-4031 FH/DAT).

The target of these inquiries is to check the techniques of recovery used by the athletes in continued or sustained sports, and then to compare them with the latest developments in scientific research, in order to then do some scientific validations and, finally, to focus some of these techniques on military and sporting applications.

According to NATO's definitions, one calls "continued operations" (CONOPS), as operations which are carried out without interruption, during a period of more than 72 hours. In this context, operators do their job in shifts during seven to twelve hours, and after that, they can rest or sleep, but they cannot leave the situation. (For example, crews in military reconnaissance aircraft, in space stations and so on.) One calls "sustained operations" (SUSOPS) as operations which are carried out in less than 72 hours, without the possibility of long pauses for rest until success has been reached. (Crews in storm-tossed sailboats, in long medical operations, or during commando operations.)

These specific situations induce a lot of fatigue and cause specific disturbances in the physical and mental capacities of the operators. To know better what happens and what operators do to recover their abilities, we made several surveys of athletes who have to manage with sustained or continued training-periods or competitions. In agreement with our "sponsors," we chose then to observe soaring pilots, because their job during training sessions and contests present some interesting analogies with the job of some categories of military operators.

1. Is soaring really a sustained and/or continued sport?

Looking at the national and international calendar of events in soaring sufficiently establishes that soaring competitions are concentrated in a reduced intensive period:

1.1 A French high-level pilot starts his training in the beginning of March, to be selected for the European or for the World Championships of the next summer. This season is closed at the end of July. It is too short a period to make a good evaluation and selection: so performances are recorded on a longer period. During the three or four months before the Championships, pilots participate in several high level courses and in one or two national competitions: most of them are not professional pilots and they can fly only during their holidays. The training load of soaring pilots is then very different from that enormous amount of work we find in other sports like gymnastics, cycling or skiing. At the international level, a dabbler pilot trains for 200 hours a year at most. It is very different with the few pilots who are professional instructors and who conduct soaring courses during the whole year, who fly 160 hours a month during the summer period, about 600 to 1,000 hours a year. They seem to come from more favorable conditions, because they regularly each experience long flights, cold conditions, high altitude and so on. So we made an observation, which was at first very surprising: the French professional pilots are not the ones who take the most part in training sessions, probably because they don't need to do it.

1.2 A contest like the World Championships is composed of eight to twelve trials, during two weeks. Each trial is a sprint on an imposed circuit of 250 to 1,000 kilometers.

The faster pilots complete the triangle at speeds higher than 100 km/h while the less fortunate ones discover the stress of very low flights and, perhaps, even landouts. Each day is a very long work-period, often of more than 12 hours: pilots must be very attentive at the briefing early in the morning, then they must closely prepare their charts, load the camera, eat something while getting dressed and then drive their machine on the field. They often have little time to relax before the flight. The noise of the tow plane opens the flight period, the starting gate opens, the pilots choose their own moment of taking a photo of the field and begin the task, which often is set for longer than six hours. These conditions are really sustained and continued ones — sustained for each day and continued for the whole contest. Recovery in these conditions is taking a much more important place during the course of each trial and as the contest goes along. Training periods look like contests; however, pilots are not obliged to produce the same sustained and continuous efforts, and they are not obliged to win. But training sessions nevertheless do seem to also produce in lower level pilots some specific fatigue, and do demand specific advance precautions of recovery.

2. Fatigue and recovery in soaring.

2.1 Soaring is really a very stressful sport, where different kinds of fatigue can occur and join together. As examples: physical fatigue, due to muscular efforts, to cold and anoxia; psychomotor fatigue, due to the rapid changes in height, in circling; sensorial fatigue, due to the alteration of light and darkness; emotional fatigue, due to risky conditions (near the mountain); attentional fatigue, due to long periods of intense vigilance; and morale fatigue, when flying very low, and late.

In a trial, pilots do their best during a long period: they have to selection information to make decisions to control their position and to note the positions of opponents — all the while in a position that facilitates physical numbness. Meteorological conditions (rapid changes of temperature) and flight at high altitude (in the wave, under oxygen) increase the needs of that sport.

The physical efforts made by soaring pilots are rarely mentioned. They have not even been recorded seriously and precisely. Thus, soaring continues to be generally thought of as a very easy sport, with moderate aerobic efforts. Yet experienced pilots know some classic situations where they have to fight against very violent natural forces — very narrow ascents, under wave zones, for example, where their job resembles that of tennis players or cyclists.

During easy flight, ergogenic needs seem to be fulfilled by the aerobic mechanisms. But the point where performances of pilots are determined by their physical abilities — such as the maximum aerobic power — is unknown, unlike other sports (see Mixajlov and Ogolcov, 1964, for skiing, for example). What is certain is that high level soaring is more and more like jogging or long swims in a pool. We have a great lack of modern data. No data exists for the transformation of lactates during contest flights, for the elimination of catecholamines, or for the recovery techniques of the pilots. It is well known that recovery presents, for example, late events: Lougovcev and Sirokov, 1974, have shown that in skiing natural recovery of VO₂ max needs 28 to 38 hours. It is too much when athletes must

undergo another trial the next day.

2.2 Dr. Menou, 1967, confirmed these facts, but his data concern only training sessions, not competitions.

2.2.1 The pilots' job, most of the time, is aerobic: "Donaggio's reaction" is very weak. On the other hand, creatinuria is undeniable during two-seater flights due to a greater physical fatigue than during solo flights.

2.2.2 The elimination of the 17-OH increases during solo flights is probably due to a higher emotional level among pilots during solo flights near the relief of the Alps mountains.

2.2.3 Soaring flights are manifestly composed of lots of stresses, having great emotional content. Changes appear with solo or two-seater flights as solo flights increase significantly the level of 17-ketosteroids, but to a smaller degree the level of 17-hydroxysteroids. This points out the importance of psychological factors.

2.2.4 The elimination of catecholamines is also significant. The relative changes of adrenalin and noradrenalin levels seem to indicate variations in the pilots' psychology. At the end of a training session, the level of noradrenalin increases among instructors, while it drops among trainees.

This short view highlights the influence of a lot of characteristic stresses, even in training conditions. When pilots are in contest, and when they must give daily good performances, it is clear that recovery may play a significant role in success or failure.

3. What does scientific research tell us about techniques of recovery?

Two aspects seem to be highlighted: The different stages of recovery; and the wide range of the mental and physical techniques of recovery.

3.1 Recovery determines the optimal data, kind, volume and intensity at which workload can be performed.

Indeed, modern training is so intensive (six - eight hours a day, for long periods) that it is now necessary to find the optimal balance between work and recovery. One cannot use only passive techniques like rest or simple sleep; active, guided techniques are very necessary and instructors must include them as an important part in the training programs, because they determine the rhythm of the training-microcycles (for example, see V.N. Platonov, 1988).

3.2 The different aspects of recovery

These aspects are classically ranged in three groups:

3.2.1 The organizational aspects: Instructors control the workload and the recovery processes by means of the training program (see also Volkov, 1983). During contests and competitions, instructors have an indirect influence on the athletes through actions on their human and material surroundings.

3.2.2 The psychological aspects: They are well-known and taken into account in recent years in the U.S., Canada and the Soviet Union, but not yet in France where instructors are still hesitant. However, the technique of psycho-regulation can help pilots to diminish significantly their psychological stress, or to uplift their motivation, to optimize the performance.

3.2.3 The medico-physiological aspects: Some of these concern more rapid treatment of several critical fatigue causes, or serve to restore the normal abilities of the subjects. For example, medical doctors give medication to

pilots who have a cold or who cannot sleep well because of hour shifting. Many of the relevant treatments are daily use by sportsmen: dietetics, showers, saunas, baths, general massages, UV radiations and so on. Such use is well known from elite contestants but specific techniques are still secret. (For example, try to see what happens in care rooms before and after a trial of the "Tour de France.")

Actually, scientific research focuses on "selective technique," by means of which athletes might have a recovery of specific mental or physical abilities. On the other hand, several scientific works ask questions of chronobiology: some techniques must be used immediately after the effort, while others may be used with advantage 48 hours after. In fact, one of the problems is to know what is the optimal moment where a particular technique of recovery can be used. Another problem is to know at which speed abilities can be recovered when using different techniques. Another is to understand why the effects of psychological overload and stress are always the last to be recovered from.

3.3 The different techniques of recovery.

3.3.1 Massage

It is the best known technique used to activate physical recovery after training sessions or matches, and for increasing the workload. Self massage is easy to learn and very effective. It consists of rubbing and kneading the muscles. Immediately after a flight this method may be applied slowly and quietly while two hours after the course, auto-massage must be done for a longer period. Vibro-massage is another technique very popular among eastern athletes. Weight lifters, for example, use vibro-massage at low frequencies, often before a contest for its toning effects.

3.3.2 Water techniques

They are important recovery techniques, such as: different categories of shower - drizzle, rotative, high pressure; baths of the whole body — in fresh or salt water, with pine-tree oil; saunas and steam-baths, providing beneficial effects on blood-circulation; and so on.

3.3.3 Physiotherapy techniques

They are more and more employed. One of these methods is "electro-myostimulation" using some specific electric currents to produce relaxing effects to improve the blood circulation and to stimulate the muscles' power. Ultra-sound reduces the pain, having an anti-inflammatory effect on tendons and muscular micro-injuries, which cannot be avoided during intensive efforts.

3.3.4 Dietetics

The different aspects of nutrition play a very important role with respect to calorie intake of proteins or low sugars, and so on. Mineral salts (such as magnesium or potassium) are of particular importance, because they are necessary for most normal biochemical reactions and because they do have an effect on muscular contractions. Different drinks or vitamin potions are prepared for improving recovery. The choice of potion depends on several environmental factors: for example, vitamin Bz for working at altitude or Vitamin E for speed.

3.3.5 Sleep and rest.

The temporal structure of rest is an important factor for recovery. Yakovlev, 1983, observed that sportsmen often have a high level of excitation after a competition, which is

pernicious because it delays recovery. So he recommends the use of gentle exercises like jogging, walking or swimming for 15 to 30 minutes while avoiding ball games because of their excitement. Sleep is another very important factor in the recovery process. Pilots should learn from a sport psychologist how to induce it through specific means like relaxation, Schultz autogenic training or yoga movements. With a psychophysicist, pilots should also learn how to manage their sleep in contest conditions. (See the "transat" sailing competitions.) It is very difficult to have good, natural sleep during championship conditions because contest conditions are not natural for most athletes. They are dependent upon specific training with personal routines to be learned a long time before hand.

3.3.6 Mental and psychological technique

Elite athletes train to know very well the tasks they must perform. With the sport psychologist, they can learn visualization, mental imagery, mental repetition, methodical performance planning, strategies of motivation, and so on. With these mental techniques which are like physical or technical ones, athletes must learn them and train in the long term — pilots may recover their morale.

Most of these recovery techniques have an effect upon both physical and psychological aptitudes, but each of them can also be used along, or in association with some others — for specific improvement requirements.

4. The technique of recovery of the French high-level soaring pilots.

According to these techniques, scientific facts, and our empirical knowledge about soaring, we can make some hypotheses to be verified by several different methods. These questions are the following: what are the techniques used by high-level pilots; are they the same as those used by middle or low-level pilots; in what conditions do pilots use them? Are there specifications with particular flight conditions; and do they have in-flight technique and what effects do they obtain with them?

In this short paper, we will only speak about the first question, what are the techniques used by French high-level soaring pilots?

4.1 Methods.

Several methods were used to get answers: a questionnaire, soon used in other sports (See Gillot et al., 1990, a, b, c, and d); several interviews with the national coach, high level flying instructors, the federal medical doctor, and old pilots; and some field observations, particularly in the WSC '89 in Wiener-Neustadt (Austria).

All data converge on the fact that recovery seems to be a decisive factor in the high-level performance, in particular, because it allows programming training flights. On the other hand, some pilots and the federal medical doctor say that passive recovery is never sufficient during the championships, meaning it is indispensable to find personal active methods, which suppose a specific training, integrated in the general training program.

What empirical cues are taken into account for estimating the pilots fitness? In flight instructors and the federal doctor mention the same ones: quality of sleep; good humor; and low heartbeat frequency at rest. On the contrary, emotional instability, maladjustment to altitude, incessant lateness during the training sessions or even during championships are signs of fatigue. The doctor

evidently take into account more clinical observations like unusual demands for sleeping pills, incessant moaning, loss of weight or nightmares.

4.2 Sample.

A questionnaire was sent or given to the 31 French soaring pilots enrolled in the 1990 national high-level list. We received 21 responses, of which 19 were workable: four out of seven in the "elite category" with two World Champions; six out of ten in the "A category" and nine out of fourteen in the "International hopes category."

In the same time, other questionnaires were given at Saint Auban among the pilots of the National Soaring Center (CNFA) and of the High Level Center (CFHN) which included flight instructors (7 received out of 15 including the two chief instructors), and trainees (41 received, of which 11 were assistant instructors).

4.3 Results.

We presently have only the data of the 19 soaring pilots. We distinguish three moments in the contest: before, during and after the trials.

BEFORE THE TRIALS

Ten pilots out of 19 say that they have rest pauses during this preparation phase. For two others, it is variable.

For most of them (15 pilots) recovery is linked to preparation. To obtain more effective resting, they have their own methods, such as: avoiding what is useless, like hopeless waiting for good meteorological conditions or having logistical problems (4 pilots); over-scrupulously preparing their machines (8 pilots); flying hard (1 pilot) or flying gently (2 pilots); and some pilots are in search of rest (4 pilots) but others train their endurance abilities with jogging or swimming (4 pilots).

With this preparation, pilots say that they try to avoid fatigue and its psychological consequences such as lack of self-confidence, sleep loss or bad humor.

Did they prepare for a long time before the competition?

The responses are varied. Four pilots say that they must work up to the contest, and they are sorry for not having much time. Five can rest while two say they try to have good sleep during the period of the preceding week. But very few have a chance to prepare like professional athletes.

What are they doing to enhance their recovery abilities? Eight do training flights progressively lengthening them, and always trying to fly back to the field. Three circuit "relax" and make observations, while some pilots jog and others do various mental preparations. They focus their attention while preparing the glider, or go out of the field for a walk or think about their former best contests. During this period they say that they take much care with their sleep.

Concerning the desired effects of this preparation, the pilots have varied opinions. Some try to enhance their physical capacities in order to be able to fly several trials without fatigue while others think it more important to have good fighting spirit, good humor and an ability to resist stress and watchfulness.

We asked several questions about their sleep in order to understand the relations between this aspect of recovery and competition. They find that sleep is very important, and they say that they would choose, if possible, their

hotel, room, bed and with whom to sleep. They all said that during a contest they wished to sleep normally. Two said they would like to sleep with their young bride, but fifteen were less romantic and said that they preferred to sleep alone. We don't know whether the sleep problems experienced by half of our pilots have any relevance to these preferences or not, but what is known is that five have big difficulty in falling asleep. One wakes several times during a night, while another sleep well — when he does not win. But if he wins he dances a jig in his bed since the soporific he must drink would be effective. So, among our best soaring pilots, some undesirable sleep disturbances appear but we do not know if it is due to the lack of young brides or to the contest conditions. We have some laboratory and field experiences to lead on the subject.

How did our pilots prepare before a trial, physically and psychologically?

As most of French soaring pilots are not professionals, they generally have no time for training and competition except during their weekends and holidays.

Thus, their preparation is usually made up of rest and sleep, in order to avoid fatigue and annoyance. A few use more active techniques such as good hot baths early in the morning with some thalassotherapies, jogging or swimming. Nutrition is also a concern for some young pilots and important to them for being at the top.

They all say that they are concerned with psychological preparation, but they differ in their techniques. One half of the pilots choose "calm and rest." They try to avoid thinking of the competition in the few minutes before starting, becoming isolated in their cockpit or in a corner of the field, relaxing with some good music or talking and joking with friends. The other half try to enhance progressively the pressure, finding motivation in positive thinking, reading maps or again studying their route choices.

With regard to their nutrition before the competition, pilots give varied answers. Some "ascetics" have no time to deal with such problems, so they eat some easy, normal and quickly prepared food like meat, bread or fruits and they drink water. The others who said before that they considered physical preparation as an important factor, are more interested with nutrition. They know that endurance athletes must eat a solid breakfast three hours before including a lot of "slow sugars" like cornflakes, rice or pastas. And they managed to do so. Several young pilots however, still have elementary ideas. They wish to eat something "light." They correctly abstain from eating fatty meat with sauce or alcohol, but they mistake the glycogenic needs of muscles with the intake of some pastry or sweets. At this level of excellence, this is surprising. Lastly, ten of the pilots know the need for vitamins and mineral salts. They say that they eat vitamin C or magnesium when they feel tired. They all drink water or potions such as "Athlon," but only one points out that hydration is very important in soaring, and that because of the altitude and the heat under the canopy, it is necessary to drink a lot before starting.

DURING THE TRIALS

Most of the pilots think that they must be in good shape, physically, nerve-wise and mentally but they do not have the same preferences, as seen by their responses.

Do they arrange short recovery pauses during the flights?

Ten out of nineteen answer yes; four say no, but explain that they have very little time for eating, drinking water, looking at the map or getting fresh air like the others. They ten pilots explain when they take such rest pauses: when at high altitude, during a straight, low transition; after a low point or several judgment errors; when their attention wanders; or after a turning point.

What are they doing to recover their (cognitive) abilities?

They make very banal answers, like drinking some fresh water, eating fruits or urinating. Four pilots give more interesting replies such as doing some relaxation movements, or taking large yoga-breaths.

What do they drink and eat in flight?

A single champion says that he does not need to eat during his flights which is very surprising during long range endurance trials. All the others say that they have something to eat and drink in their glider. They generally know the risk of dehydration and they say that they drink a lot during the trial and before. They drink water, or vitamin potions like "Athlon," "Gatorade," and so on. We think that drinking one liter of water during a trial is not too much. We measured last year, during 4 hour training flights in Saint Auban, several losses of weight up to 3 kilograms. We think that pilots must pay more attention to dehydration, which produces very sudden physical fatigue and judgment loss or mental incoherence.

Most pilots eat cakes or chocolate, both for nutrition and for pleasure (rewarding themselves "for their good decision making").

AFTER THE FLIGHT

When their glycogenic stocks have been used up, endurance athletes try to recover it with a ration of rapid sugars about 20 minutes after the landing. They also try to start the recovering mechanism while drinking such mineral waters as "Perrier" or "Vichy." It is also well-known to these athletes that they would become less tired if they would start active recovery processes as soon as possible after the competition. Most French pilots know this. They say that they are interested in these aspects of recovering, but they have difficulties because a flight is not finished at landing. Pilots still have several tasks to do, meaning they must recover at a later time, before the evening meal, for example.

They use several common techniques of recovery: relaxation in a calm room, hydration, ball games, jogging, bath and showers, massage, eating, and sleep. But they do not seem happy with their choices. This would be understood as a cue of the varied abilities the pilots can use, because of their own pile-driving styles in the same flights: so they try to recover with their own cocktail of varied techniques. For example, one demands to eat a steak first, others drink a beer while talking about the flight with friends, while another one needs to swim alone for an hour. None of these seems to be eccentric.

However, it is very surprising that pilots do not use more specific and active recovery techniques, which are used in other endurance sports like skiing or cycling, such as low activity, Schulz autogenic training or yoga breathing to induce easier and better quality sleep, stretching or dietetics to recover physical form, relaxation, stress management or mental exercise to recover perceptual, decisional

and cognitive capacities, or any of a number of others.

This can be understood as a consequence of the institutional status of soaring in France, which is still more an aerial practice than a sporting one. So, soaring emphasizes in-flight training. But specific physical endurance training programs, psychological preparation and after-trial recovering methods, which have been used for a long time at a high level in most sports, do not seem to be well-known among pilots.

IN CONCLUSION

This survey has shown that pilots of high-level are generally more conscious of the importance of recovery than others. We have found much convergence between the scientific modern findings and what the French pilots actually try to do. Most of them say that they do have methods to enhance before, during and after a contest the recovery of their aptitudes, which are often reduced during long repeated sustained flights. It is possible to summarize these habits as follows:

1. Before the contest: Avoid all useless events; prepare the glider; improve endurance abilities by jogging and progressively lengthening the flights; and rest, flying gently, having a good sleep.

2. During the trials:

- 2.1 In flight techniques: short pauses, deep yoga breathing; hydration - drinking 1 liter of water; and nutrition - eating cereals, chocolate.

- 2.2 Each evening: sleep disturbances - soporifics; psychological recovery - calm and rest and positive thinking of the competition; and physical recovery - relax in calm, ball games, swimming or jogging, showers, massages, eating and drinking, sleep.

3. After the contest: no time, working again; and sleeping.

But we have established that it is actually the few best ones who are generally curious about the problems. Their knowledge is still empirical and incomplete, and they regret not having scientific lectures with us nor practical exercises and field works to learn much more. Their answers show varied techniques, and eventually discrepancies about the results they achieve.

We have suggested that the various answers could be explained by the fact that pilots have different piloting styles, using various abilities. This we are now studying, trying to point out the different abilities which are used by pilots at the several levels of performance.

But we also found among younger pilots over ingenious and false ideas about the physical and psychological way to prepare for a contest. At high levels of performance this is very surprising. It can be understood, however, because of the administrative status of soaring in France, which is considered "aerial practice" and is not yet the status of "sporting practice."

Our soaring specialists train as pilots, but not as athletes.

However, important progress has been made in the last ten years to change this status and to improve in some ways the training of the young soaring "athletes." Such progress is evident: by opening a High Level Soaring Center, also in Saint Auban; by giving young pilots a more athletic training program (including dietetics and physical training); and by trying to improve psychological preparation, as in sailing.

These changes do not yet include the improvement of scientific knowledge about the physical and mental aspects of pilots' form. So if some of their recovering techniques are now tested in our laboratory and during simulated contest flights, the testing is quite marginal. The French soaring association is not yet interested in such researches or with the advances in matters like psychological preparation. Such difficulties are for us a matter of conscience. We cannot continue working with our PhD students without money and the contribution of high-level pilots; therefore, we have to have some collaboration with teams in other sports.

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