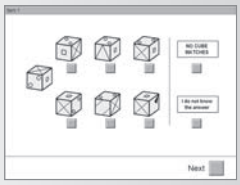
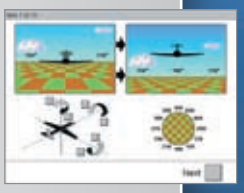
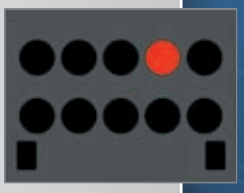
Expert System Aviation

test battery
based on JAR-FCL3







Catalog

SCHUHFRIED
Qualität durch Kompetenz

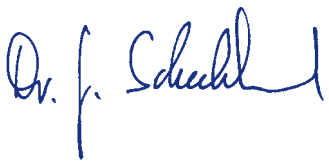
Contents

The increased complexity of aviation does not only make greater demands on pilots but also on aviation psychological assessment systems used to select suitable pilot candidates.

The SCHUHFRIED company developed a computerized assessment system which made it market leader in the field of ability and personality assessment since several years. This computerized assessment system is called „Vienna Test System“ and is marked out by permanent development and scientific research to increase its effectiveness and validity for a wide range of civil and military aviation psychological applications.

A substantial core authority of the SCHUHFRIED Company is located in the field of traffic psychological assessment, whereby aviation psychological assessment represents its own main focus.

The SCHUHFRIED Company is proud to present a new and innovative aviation psychological test battery which is aimed at the objective and valid identification of suitable candidates for an aviation education. The high psychometric standard and practical utility of this test battery certainly sets new standards within the field of the aviation psychological assessment!



Dr. Gernot Schuhfried

Expert systems are computerized assessment systems developed to assist the diagnostician during the judgment formation process by providing necessary information based on empirical validation studies.

The test battery AVIATION is at the core of the Expert System Aviation. It is optimized to the general needs of Civil and Military Aviation and contains tests for all relevant criteria, following the requirements of the JAR-FLC3. The individual tests are well proven according to the standards of modern psychological assessment and were developed at a high psychometric standard.

The main variables of the individual tests are reported both as raw scores and as percentile ranks in relation to the norm; they are also displayed in a diagrammatic profile. In addition, the test battery AVIATION calculates an overall score of the candidate's suitability.

AVIATION Test Battery

Achievement tests of the Aviation Expert System and their measurement range in accordance with JAR-FCL3.

Operational aptitudes	Test	Reliability	Test duration
Logical reasoning	INSBAT: Figural-inductive Reasoning	0.70[a]	15 mins.
	INSBAT: Numerical-inductive Reasoning	0.70[a]	15 mins.
Mental arithmetic	INSBAT: Computational Estimation	0.70[a]	13 mins.
	INSBAT: Arithmetical Competence	0.70[a]	8 mins.
Memory function	INSBAT: Visual Short-term Memory Test	0.70[a]	9 mins.
Concentration	COG: Cognitrone	0.95	10 mins.
	SIGNAL: Signal Detection Test	0.85	15 mins.
Vigilance	VIGIL: Vigilance	0.95	30 mins.
Perceptual Speed	ATAVT: Adaptive Tachistoscopic Traffic Perception Test	0.80[a]	10 mins.
Perceptual Closure	GESTA: Gestalt Perception Test	0.94	15 mins.
Visualization	INSBAT: Visualisation	0.82	15 mins.
Spatial orientation	PST: Pilot's Spatial Test	0.74	15 mins.
Psychomotor coordination	SMK: Sensomotor Coordination	0.90	10 mins.
Choice reaction time	DT: Determination Test	0.98	10 mins.
Decision Making	INSBAT: Inspection Time	0.94	5 mins.
	INSBAT: Decision Quality and Speed	0.96	10 mins.
Multi-Task Ability	SIMKAP: Simultaneous Capacity / Multi-Tasking	0.94	15 mins.

[a] Target reliability of an adaptive test: The test ends when this level of reliability for the respondent's test result has been achieved.

Test battery

Personality scales of the Aviation Expert System and their measurement range in accordance with JAR-FCL3

Dimension assessed	Eysenck Personality Profiler 6	Test duration
Need for achievement	Ambition	
Vitality	Hypochondria	
Sociability	Sociability	
Mobility	Activity	
Acceptance of responsibility	Irresponsibility	
Risk-taking	Risk-Taking Impulsiveness	30 mins.
Dominance / Assertiveness	Assertiveness	
Empathy	Manipulativeness	
Aggression	Aggression	
Emotional stability	Anxiety	
Readiness to bear privations	Unhappiness	
Flexibility	Dogmatic	

These tests can be combined into individual test batteries designed to suit your specific needs.

The input devices of the **Expert System AVIATION** have been developed in view to ergonomics and user friendliness. Thus persons who are not accustomed to the use of computers are not disadvantaged.

The test battery AVIATION requires the Universal Response Panel as well as the Digital Foot Pedals and the Analog Foot Pedals.

Universal Response Panel

- Seven colored buttons
- Ten numbered buttons
- One sensor button
- Two analog joysticks
- Loud speakers or head phones
- USB - interface

Digital Foot Pedals

- The Digital Foot Pedals are connected to the Universal Response Panel
- The Digital Foot Pedals are used like a switch

Analog Foot Pedals

- The Digital Foot Pedals are connected to the Universal Response Panel
- The Analog Foot Pedals are necessary for the Sensomotor Coordination Test (SMK)

Test administration

The comprehensible and clearly developed test administrator interface and client data administration provide for a pleasant and comfortable application.

In a first step the client's social data (e.g. name, age, gender etc.) are entered. Furthermore, the client's native language can be selected during the input of the social data from a list - the individual test procedures are then accomplished in this language.

The list of different languages available for the administration of the test battery is continuously expanded.

Instruction

Each tests is started with a **standardized instruction.** This is done automatically on screen via the test system and the test administrator is usually not required.

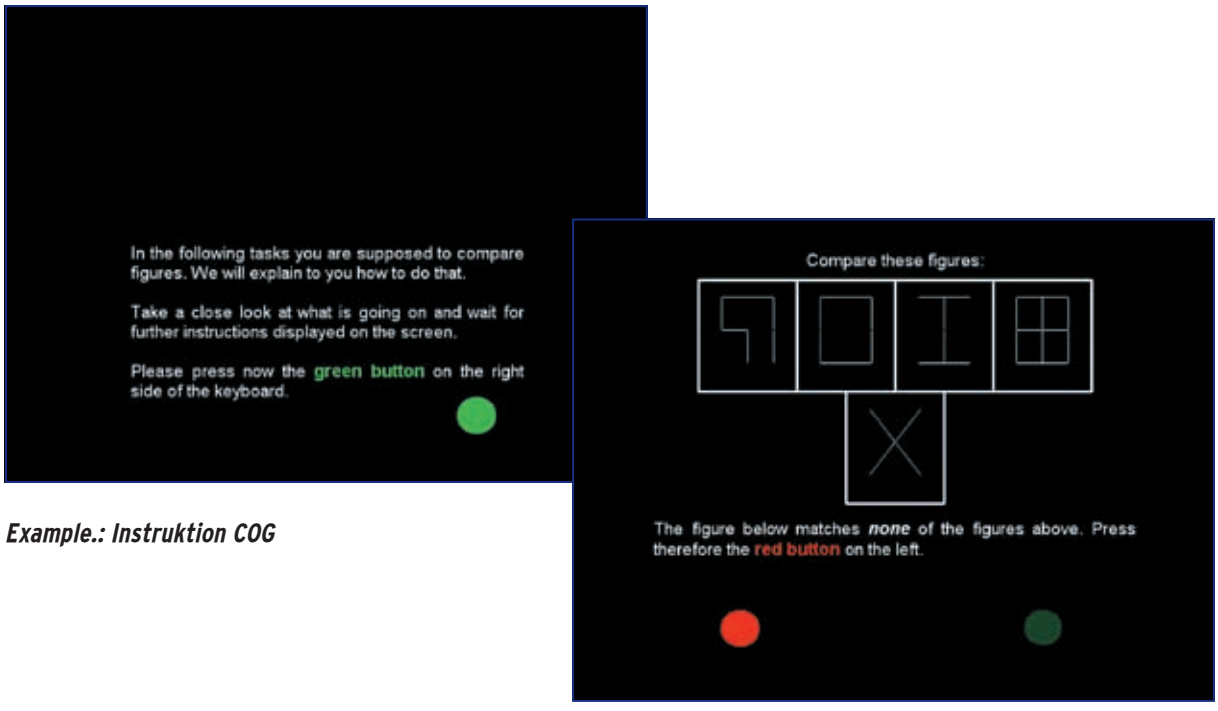
Practice phase

After the instruction an practice phase follows, in which the client is familiarized with the test and the understanding of tasks is ensured. The instructions and practice exercises are frequently linked and constructed according to the **principle of programmed learning.**

Test phase

After instruction and practice phase the client starts to work on the individual test items. This procedure ensures **highest objectivity of execution.**

At the end of the assessment process the test results are stored in a data base and can be printed out in clear form and/or processed electronically.



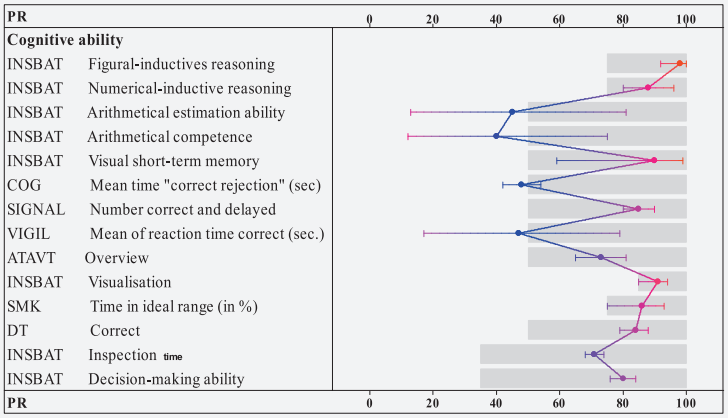
Example.: Instruktion COG

The evaluation of the test battery AVIATION is done automatically. The test results are presented uniformly both in tabular form and as a test profile.

The raw scores and corresponding percentile ranks of main variables of the individual tests used in the test battery AVIATION are reported in the **result tables**. The norm value comparisons used to calculate the percentile ranks always refer to the representative norm sample. The coloured **profile** enables this information to be taken in at a glance. The normal range is shaded grey so that deviations are immediately visible.

DEMO record!
born 05.10.1976, male, 51;1 years, Education level 3
Scoring code:
Test administration: 26.11.2008

Profile:



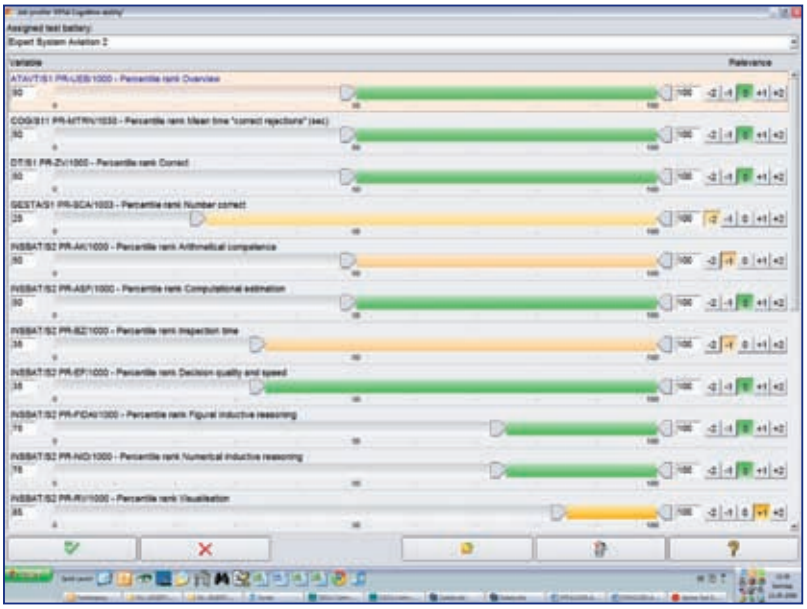
Test results:

Test variable	Raw score	Parameter	PR [1]
Logical reasonsing			
INSBAT - Figural inductive reasoning		1.527	98 (92-100)
INSBAT - Numerical inductive reasoning	14	0.813	88 (80-96)
Mental arithmetic			
INSBAT - Arithmetical estimation ability	8	-0.518	45 (13-81)
INSBAT - Arithmetical competence	12	0.618	40 (12-75)
Memory function			
INSBAT - Visual short-term memory		2.576	90 (59-99)
Attention			
COG - Mean time "correct rejection" (sec)	3.18		48 (42-54)
COG - Sum "hits"	24		82
COG - Sum "correct rejection"	35		54
SIGNAL - Number correct and delayed	52		85 (80-90)
Vigilance			
VIGIL - Mean of reaction time correct (sec.)	99		47 (17-79)
VIGIL - Number of correct	0		90 (77-100)
Perception			
ATAVT - Overview		0.890	73 (65-81)
Visualisation			
INSBAT - Visualisation		2.643	91 (85-94)
Psychomotor Coordination			
SMK - Time in ideal range (in %)	26		86 (75-93)
Resilience			
DT - Correct	276		84 (79-88)
Decision-making			
INSBAT - Inspection time		0.970	71 (68-74)
INSBAT - Decision-making ability		0.620	80 (76-84)
Summary of aptitude			
Cognitive aptitude	848		

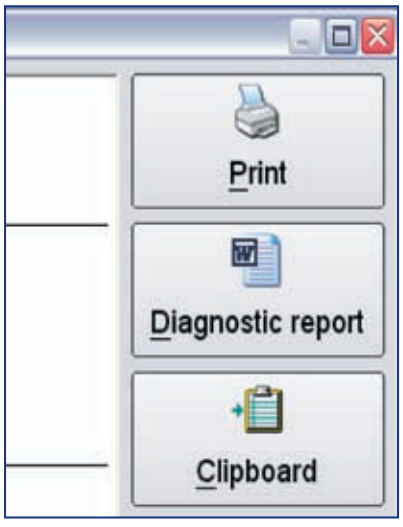
Comment(s): The confidence intervals are displayed next to each of the comparison scores (in parentheses).
[1]The percentile rank (PR) results from comparison with the age-independent norm sample.

Result presentation

The Expert System Aviation incorporates a previously prepared requirements profile for ability and personality dimensions. The profile is used in combination with the test scores to calculate an overall score of the candidate's suitability. **Candidates with an overall score <750 ‰ will probably be unable to compensate for their weaknesses through strengths in other areas; they should be classified as "unsuitable"**. You can of course further refine your requirements profiles at any time you choose.



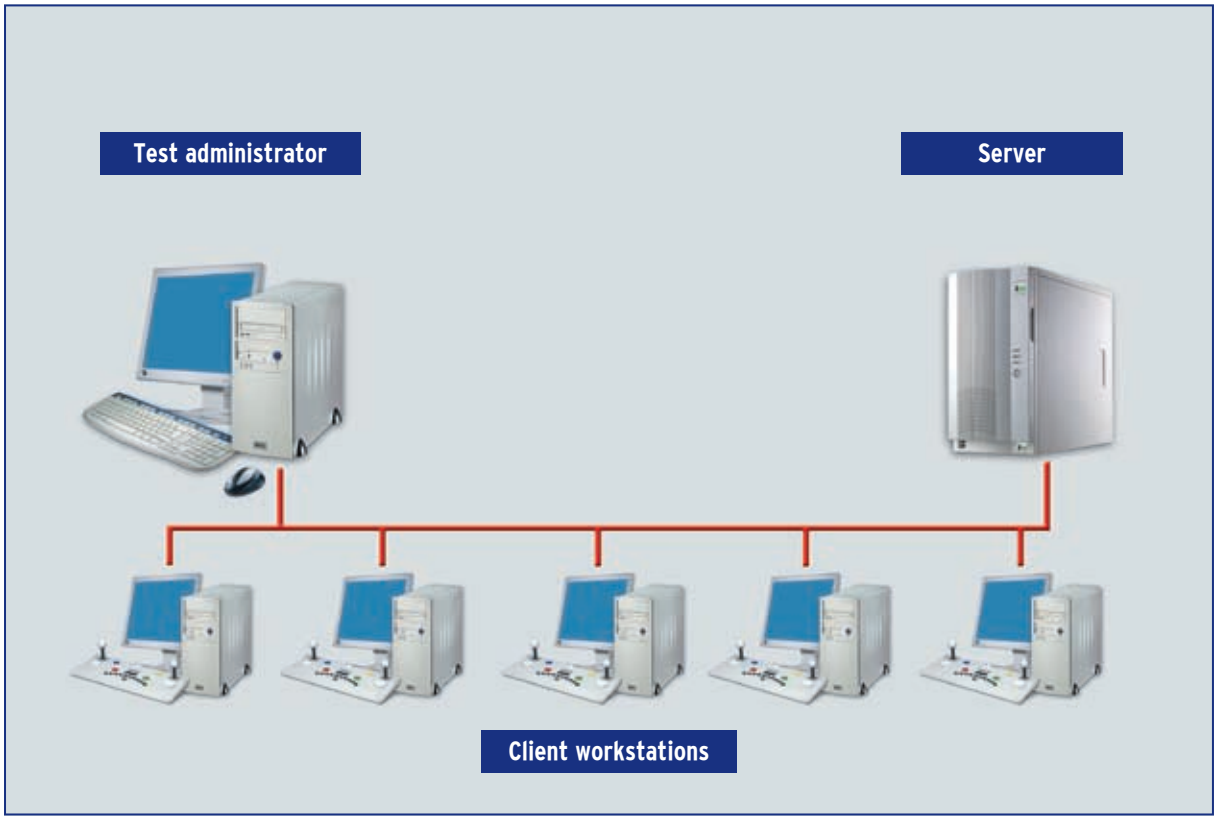
Those candidates who have not been excluded in the previous selection steps are ranked in order of their likelihood of suitability. **This ranking list enables the required number of candidates to be taken forward to the next stage of pilot selection.**



The results of the Expert System Traffic can be printed out at any time.

With a single mouse click the results can be exported directly into a wordprocessor such as Word and edited there.

The results can be saved on the clipboard and copied from there into other documents.



Test System Network - Experten System Aviation

If a big number of respondents are to be tested it is recommended to set up a VTS network. This consists of an administrator work place and an almost unlimited number of client workstations. The test administrator work place serves as central unit for storing the client data, preparing the test battery and displaying the test scores.

Storing the data on a central computer makes administration, processing and saving of data comfortable and simple.

The results from all the workstations can be printed on a common printer. For networks consisting of more than 15 client workstations a file server should be installed in addition to the test administrator workstation. The client workstations are completely independent of each other allowing clients to work on all the workstations simultaneously. Thanks to the independence of the workstations each client can work on his test place at his individual pace of work.

A special function (AutoTest) allows to prepare test sequences for different clients in advance. At the start of the assessment each of the respondents logs on with a specific code on any workstation where the test battery is to be presented. The administrative tasks for the test administrator are kept at a minimum.

Defining the respondent database

To enable the respondent database to be adapted to individual requirements, the number of input fields can be changed in order to define the database template. Apart from the standard fields of name, first name, date of birth, gender, educational level, scoring code and language, all fields can be changed and re-defined.

Exporting data

Via suitable interfaces respondent data and test results can at the touch of a button be exported into the customer's own respondent administration programs.

All data can be exported into commonly used statistical programs (e.g. Excel and SPSS) for further statistical processing. An ASCII file can also be produced. If necessary the data can be exported in anonymized form.

Help function

The Expert System Aviation includes context-sensitive help. Information on all aspects of the system will be found here, from installation and use of the test battery to "hints and tips" and literature references. Manuals for all the tests are available in digital form.

Checking of test devices

According to ISO 13485:2000 the functional correctness of the testing equipment should be checked periodically. A special easy-to-use self-test program is available for this purpose. The result of this test is displayed on the screen and can be printed out to provide documentary evidence of the equipment test.

Data protection

Personal data are stored in the database in encrypted form.

Access can be authorised at different levels and is controlled by three passwords. Only authorised persons can change the system settings or access personal data.

General Quality Criteria of the Test Battery

Objectivity

Like all standardized computer tests, the **Expert System Aviation's** test procedures offer a maximum of test administrator independence, as well as security against miscalculation and unambiguousness of interpretation (see Kubinger, 1996).

Reliability

In the test procedures for the assessment of operational aptitudes measuring accuracies between 0.70 and 0.99 were determined. In the test procedures for the assessment of personality factors measuring accuracies between 0.60 and 0.97 are found. The indices of **Expert System Aviation's** individual test procedures can be found in the chapter description of the tests. Therefore the measuring accuracy is to be consider as high.

Economy

The **Expert System Aviation's** tests are economic regarding the test administrator time, since instruction and evaluation times for the test administrator are annulled. Beyond that the **Expert System Aviation** offers the possibility for the execution of staged testing with the help of a networked system, whereby the diagnostic process can be arranged more economic as well.

Usefulness

„A test is then useful, if it measures a personality trait and for its investigation exists a practical need." (Lienert & Raatz, 1994, p.19) The practical need for the available test procedures results from the recommendations of the JAR-FCL3 about the dimensions which can be described in the context of aviation psychological assessment. Thus a high usefulness can be certified to the **Expert System Aviation.**

General Quality Criteria of the Test Battery

Reasonableness

This refers to the extent by which a test battery or an individual test, relative to the diagnostic benefit resulting from the application, is easy on the tested person (Kubinger, 1996). The control criterion of reasonableness is fulfilled, since only those test procedures are presented, which are necessary for a valid evaluation of the suitability of the pilot candidates.

Fairness

It is maintained again and again that the computer represents an additional stress factor in the test situation and that persons with little computer experience would be disadvantaged. In this context however Klinck (2002) could recently prove that with adequate implementation of the test procedures no disadvantage of persons with little computer experience takes place. In addition the **Expert System Aviation** offers a special input hardware, with whose assistance age and education-related problems in handling computers are overcome.

A further point speaking for the **Expert System Aviation's** higher test fairness is the type of the instruction presentation. The test instructions and exercise phases of the individual test procedures were arranged in such a way that the test is given only if the task of test was understood.

Standardisation

According to Kubinger (1995) a test fulfils the control criterion of standardisation, if the following conditions are satisfied: The standards did not become outdated and the populations for whom the standards apply are defined. With the **Expert System Aviation's** test procedures a comparison with age-independent, population-representative standards, based on census results from Germany and Austrian, is carried out.

Validity of the Expert System Aviation

The Expert System AVIATION was validated in two independent studies. In both studies the aptitude as- sessment is done on the basis of a global evaluation of the candidate's performance in a standardized flight simulator, which is to be predicted as a result of the test battery AVIATION.

In study 1 altogether 99 male pilot applicants with an average age of 20.4 years and a standard deviation of 1.85 years participated. The data were collected in the context of a validation study in co-operation with a European military air-force.
The evaluation of the suitability took place via a global evaluation by means of the performance of the person in a standardized flight simulator. On the basis of their overall evaluation the clients were divided into a group with positive respectively negative evaluation. Al- together 54 per cent of the sample received a positive evaluation of their performance in the standardized flight simulator.

In the second study altogether 81 male and 1 female pilot applicants with an average age of 26.9 years and a standard deviation of 4.7 years participated. The data of study 2 were collected in co-operation with a European civilian air line. The evaluation of the suitability took place likewise on the basis of a global evaluation by means of the person's achievement in a standardized flight simulator. Altogether 46 per cent of the persons in study 2 received a positive evaluation of their performance in the standardized flight simulator. Furthermore, all pilot applicants, with a positive global evaluation of their flight simulator performance successfully completed a subsequent aviation education.

Study 1:

Based on their test results in the test battery AVIATION approximately 90 per cent of the applicants can be judged correctly with regard to their performance in the standardized flight simulator. This corresponds to a validity coefficient of R=0.79. The sensitivity is about 94 per cent, while specificity amounts to 85 per cent.

On the x-axis in figure 1 the probability of a positive evaluation of the performance in the standardized flight simulator based on the applicants tests results is presented. The y-axis shows the relative frequency of the applicants evaluated positively respectively negatively in the standardized flight simulator. Applicants with positive global evaluation (yellow bars) respectively negative global evaluation (blue bars) are displayed separately regarding their performance in the standardized flight simulator. The blue bar at 0.00 – 0.10 thus represents applicants, who received a negative global evaluation of their performance in the standardized flight simulator and were classified as successful candidates based on their test results with a classification probability between zero to ten percent. The yellow bar at 0.91 – 1.00 on the other hand represents candidates with a positive global evalu- ation in the flight simulator, who were classified as successful candidates based on their test results with a classification probability >.90.

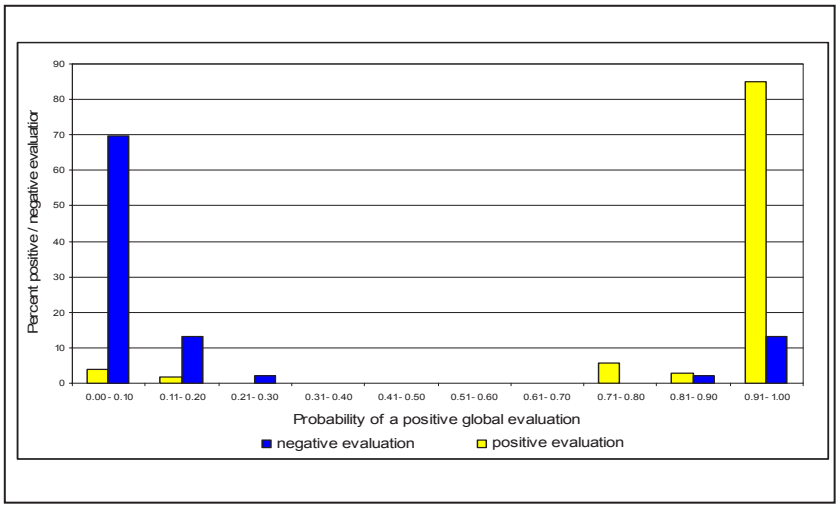


Figure 1: Distribution of the sample on the classification probabilities in the jack-knife validation.

The statistical model which lead to a validity of R=0.79 (90% correct classifications) consisted of the tests INSBAT, DT and SMK. The relative relevance of each test for the outcome of the test battery is listed in the table.

test	relative relevance
INSBAT: Figural-Inductive reasoning	18 %
INSBAT: Visualization	13 %
INSBAT: Visual Short-term Memory	23 %
DT: Determination Test	31 %
SMK: Sensomotor coordination	15 %

Study 2:

In study 2 approximately 94 per cent of the applicants can be judged correctly regarding their performance in the standardized flight simulator based on their test results in the test battery AVIATION. This corresponds to a validity coefficient of R=0.90. The sensitivity is about 100 per cent, while specificity amounts to 90 per cent.

On the x-axis in illustration 2 the probability of a positive evaluation of the performance in the standardized flight simulator is presented according to the available test results. The y-axis shows the relative frequency of the persons evaluated positively respectively negatively in the standardized flight simulator.

Persons with positive total evaluation (yellow bars) respectively negative total evaluation (blue bars) are displayed separately regarding their performance in the standardized flight simulator. The blue bar at 0.00 – 0.10 thus represents applicants, who received a negative global evaluation of their performance in the standardized flight simulator and were classified as successful candidates based on their test results with a classification probability between zero to ten percent. The yellow bar at 0.91 – 1.00 on the other hand represents candidates with a positive global evaluation in the flight simulator, who were classi- fied as successful candidates based on their test re- sults with a classification probability >.90.

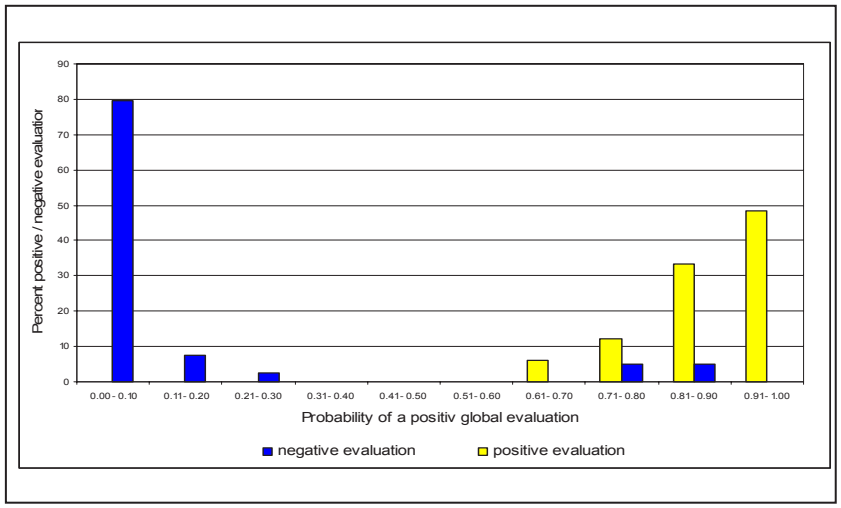


Figure 2: Distribution of the sample on the classification probabilities in the jack-knife validation

The statistical model which lead to a validity of R=0.90 (94% correct classifications) consisted of the tests COG, SIGNAL, VIGIL and ATAVT. The relative relevance of each test for the outcome of the test battery is listed in the table.

test	relative relevance
COG: Cognitrone	31 %
SIGNAL: Signal Detection	16 %
VIGIL: Vigilance	25 %
ATAVT: Adaptive Tachistoscopic Traffic Perception Test	28 %

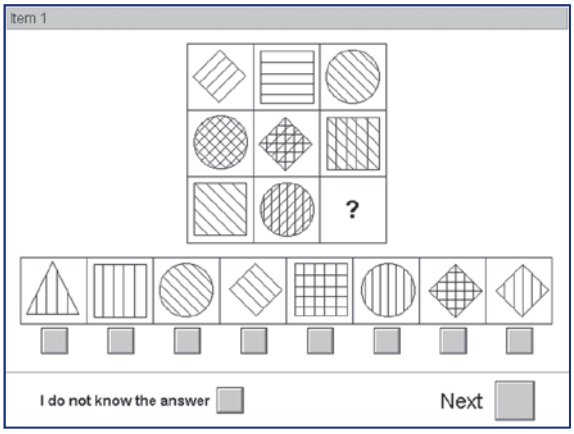
Achievement tests

Logical Reasoning

The ability to detect rules and to apply them.

INSBAT: Subtest Figural-Inductive Reasoning

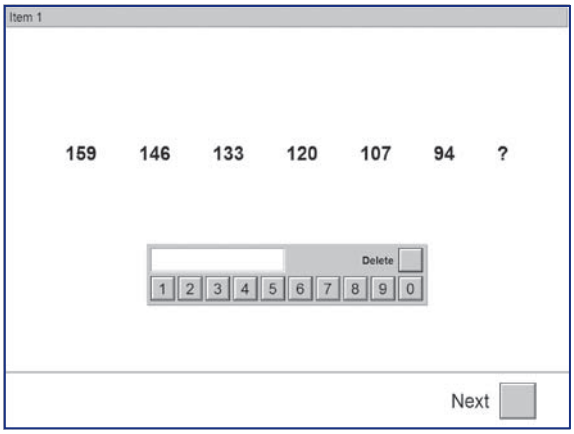
The items resemble classical matrices, but they are based on explicit construction rationale. 300 items were created on the basis of these rules and they were evaluated with a large sample of people in extensive international studies. Probabilistic characteristic values were estimated for the items. Due to the adaptive test presentation, an optimal compromise between test reliability and economy is achieved. The presentation of just about 15 items yields the desired test accuracy. In addition, the test adapts to the motivational situation of the respondent in order to meet the best individual level of challenge, thus keeping test taking motivation high. Item selection is adaptive out of a pool of 300. It is not possible to omit an item or to return to a previous one. The 9 answer options are designed to reduce the probability of a respondent to guess results. The reliability of the test according to Cronbach's Alpha is 0.82.



As a part of a test battery, that could correctly predict success in a flight simulator in 90% of the cases (corresponding to a validity coefficient of R=0.79), INSBAT: Figural-Inductive Reasoning contributed a relative relevance of 18% to the model.

INSBAT: Subtest Numerical Inductive Reasoning

According to Holzman, Pellegrino & Glaser (1983) and Vergust, Maris & DeBoeck (2002) number series tasks measure inductive reasoning, which is considered a sub-dimension of the secondary stratum factor "fluid intelligence" in the framework of the modified gf-gc theory (Horn, 1989; 1991; Horn & Noll, 1997).
The respondent is presented with several number series and has to induce the logical relationship between the numbers in each number series in order to complete it. The test uses a free entry format. It is not possible to correct previously completed items or to skip items. The reliability of the test according to Cronbach's Alpha is 0.80.



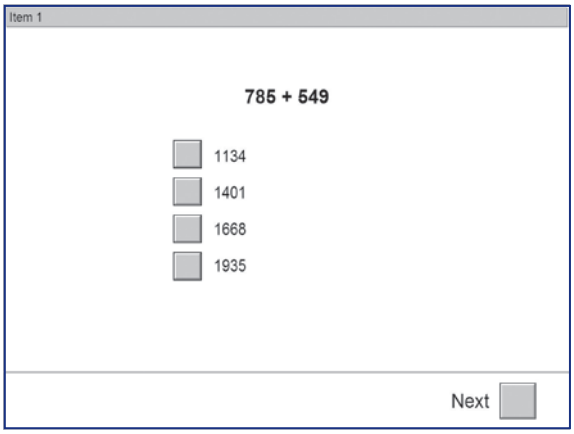
Mental Arithmetic

The ability to mentally operate with numbers and to solve simple and more complex computational problems.

INSBAT: Subtest Computational Estimation

According to Greeno (1991) and Rubenstein (1985) computational estimation tasks measure number sense, which is considered a sub-dimension of the secondary stratum factor "quantitative thinking" in the framework of the modified gf-gc theory (Horn, 1989; 1991; Horn & Noll, 1997).

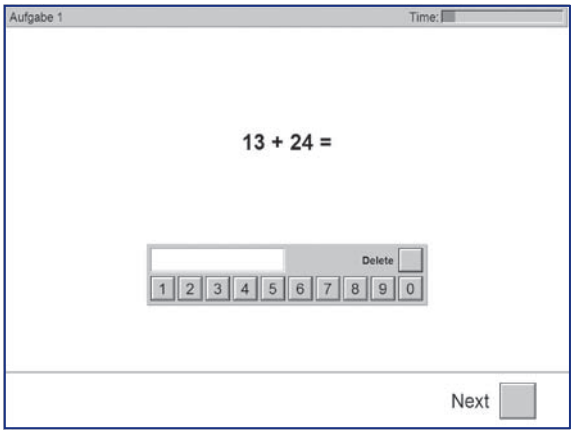
The respondent has to estimate the results of several arithmetic problems and select the answer alternative which is closest to the actual result. It is not possible to correct previously completed items or to skip items. The reliability of the test according to Cronbach's Alpha is 0.73.



INSBAT: Subtest Arithmetic Competence

The Base for the test Arithmetic Competency is the construct of the ability to calculate, which is considered a sub-dimension of the secondary stratum factor "quantitative thinking" in the framework of the modified gf-gc theory (Horn, 1989; 1991; Horn & Noll, 1997).

The respondent has to complete a sequence of arithmetic operations under time constraint. The test uses a free entry format. It is not possible to correct previously completed items or to skip items. The reliability of the test according to Cronbach's Alpha is 0.78.

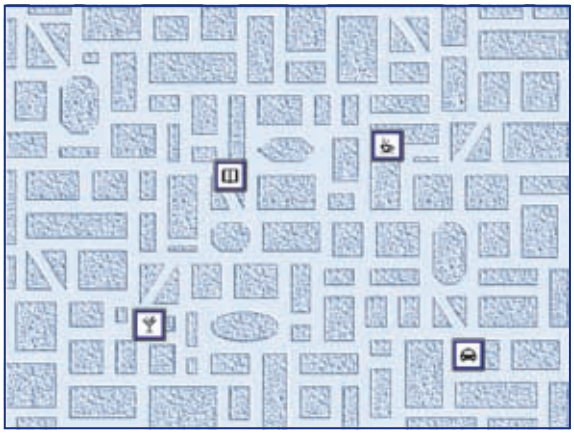


Memory Function

The ability to memorize and retrieve from memory visually and/or verbally coded information.

INSBAT: Subtest Visual Short Memory Test

The tasks that were created on the basis of an explicit rationale construction to assess visual memory performance, which is especially relevant as a partial aspect of orientation: the build-up of the so-called memory point knowledge. The presentation of just about 15 items yields the desired test accuracy. In addition, the test adapts to the motivational situation of the respondent in order to meet the best individual level of challenge, thus keeping test taking motivation high.
The item selection is adaptive out of a pool of 127. It is not possible to omit an item or to return to a previous one. A map of a city is presented to the respondent, on which typical locations are marked by content-coded symbols. The task of the respondents is to remember the location of the symbols. The reliability of the test according to Cronbach's Alpha is 0.70.



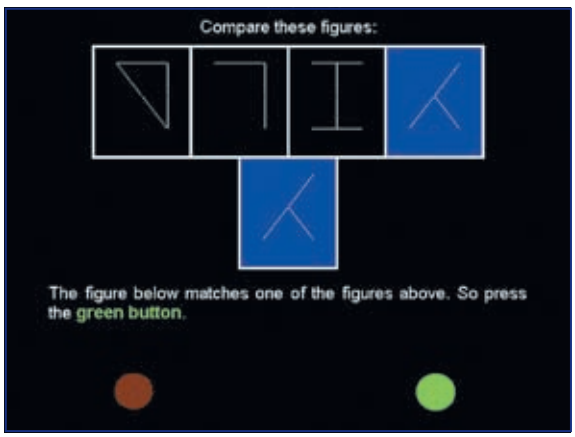
As a part of a test battery, that could correctly predict success in a flight simulator in 90% of the cases (corresponding to a validity coefficient of R=0.79), INSBAT: Visual Short-Term Memory contributed a relative relevance of 23% to the model.

Concentration

The ability to direct attention for a long time to a task in order to attain a stable performance.

COG: Cognitrone

Cognitrone is based on the Reulecke's theoretical model, which sees concentration as a state that is essentially described by three variables: Energy, Function and Precision.
The tasks consist of comparing an abstract figure to a given model and assess its equality. After the answer was entered, the next item follows automatically. Correcting or skipping an item, or going back to a previous one, is not possible. The reliability (Cronbach's Alpha) of the variable 'sum correct reactions' is 0.86. As a part of a test battery, that could correctly predict success in a flight simulator in 94% of the cases (corresponding to a validity coefficient



of R=0.90), Cognitrone contributed a relative relevance of 31% to the model.

SIGNAL: Signal Detection

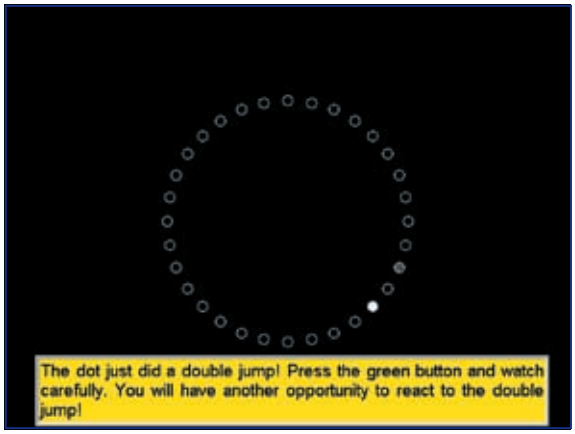
SIGNAL is based on the Signal detection theory (by Green and Swets, 1966) which describes the perception of weak signals on a constantly changing background. The entire screen is covered with dots, some of which randomly disappear while other new ones appear. The respondent is required to detect the critical stimulus constellation, that is, whenever four dots form a square. An internal consistency (Cronbach's Alpha) of 0.85 for the variable 'Number correct and delayed' was found. As a part of a test battery, that could correctly predict success in a flight simulator in 94% of the cases (corresponding to a validity coefficient of R=0.90), SIGNAL contributed a relative relevance of 16% to the model.

Vigilance

The ability to maintain a state of readiness for a long time, in order to detect and respond to certain specified infrequently occurring events.

VIGIL: Vigilance

The demands on vigilance are determined by the following factors: During a longer testing time, the respondent is required to show continuous attention. The relevant signals appear randomly and do not automatically attract attention. This requires a relatively low intensity of stimulus presentation and a low frequency of critical incidents. According to the neurophysiological activation theory, the cortex is insufficiently stimulated by the increasing reticular activation system (ARAS) due to a lack of stimuli. Generally, a maximum of 60 critical stimuli per hour are suggested. The drop in performance during vigilance experiments is due to the decrease in the activation level of the respondent accompanied by the growing reaction latency. A brightly flashing dot moves along a circular path, moving forward one field at a time. Occasionally a field is skipped and the respondent has to react by pressing a button.



An internal consistency (Cronbach's Alpha) of 0.86 for the variable 'Number of correct' and of 0.77 for the variable 'Number of incorrect' was found. As a part of a test battery, that could correctly predict success in a flight simulator in 94% of the cases (corresponding to a validity coefficient of R=0.90), Vigilance contributed a relative relevance of 25% to the model.

Perceptual Speed

The ability to perceive information quickly and accurately, simple as well as complex material.

ATAVT Adaptive Tachistoscopic Traffic Perception Test

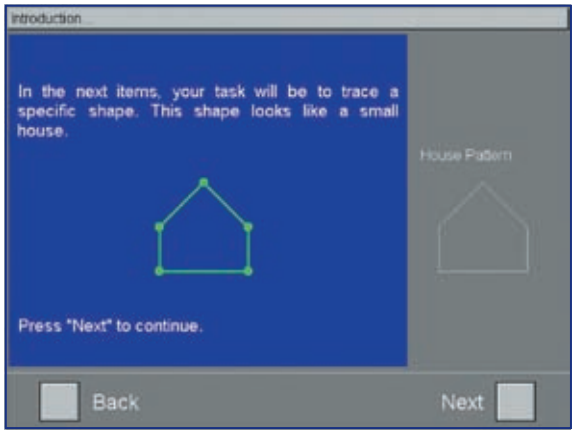
The test assesses visual perception and perceptive speed in tasks where pictures of simple as well as more complex traffic situations are presented for a very short moment. The test is constructed and evaluated according to the Rasch-model. The respondent is confronted with about 20 images for the duration of one second each. After each image the respondent is asked to indicate in a list of five dif- ferent options, what s/he has seen in the picture. For each respondent an internal consistency (Cronbach's Alpha) of r=0.8 can be ensured.

Perceptual Closure

The ability to recognize incomplete forms, i.e. to form "Gestalts" from surrounding patterns.

GESTA: Gestalt Perception Test

The GESTA was developed on the basis of the hierarchic model perception and therefore assesses the ability of disassembling and assembling structures. GESTA is constructed according to modern test theory and assesses the cognitive construct of field dependence one-dimensionally.
The task is to identify a pre-defined shape in a complex pattern and to mark its corners. The respondent has 20 seconds per item to find the solution. An item is considered as solved as soon as the shape was drawn correctly within the preset time limit. An internal consistency (Cronbach's Alpha) of 0.92 for the variable 'Number of correct' was found.

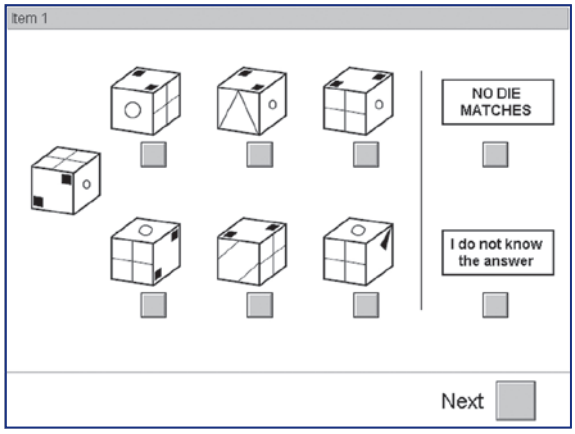


Visualization

The ability to construct an appropriate mental image of two or three-dimensional spatial patterns and to manipulate or to transform these images into other visual arrangements.

INSBAT VISUALIZATION

The validity and unidimensionality (Rasch-homogenity) of the test Visualization have been confirmed in many empirical studies. This means that the same latent ability dimension is assessed in all respondents. The test task is to mentally rotate patterned cubes in order to verify which one corresponds to a visual sample stimulus. It is not possible to omit an item or to return to a previous one. The 8 answer options are designed to reduce the likelihood of a respondent to guess results. An internal consistency (Cronbach's Alpha) of 0.91 for the variable 'Spatial perception' was found. As a part of a test battery, that could correctly predict success in a flight simulator in 90% of the cases (corresponding to a validity coefficient of R=0.79), the test Visualization contributed a relative relevance of 13% to the model.



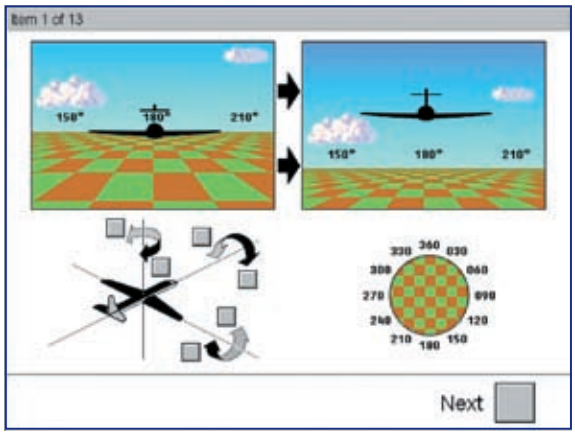
Spatial orientation

The ability to rotate mental images about one or more of the three spatial axis and of switching from an egocentric to an allocentric reference frame.

PST: Pilot's Spatial Test

The test focuses on two skill components: firstly, on the skill of rotating mental images about one or more of the three spatial axis (mental rotation), and secondly, on the ability of switching from an egocentric to an allocentric reference frame. A homogenization of the item pool according to the Rasch model guarantees that subjects cannot apply any other solution technique than that required and thereby utilize other skills.

For the ability parameter variable the internal consistency (Cronbach's Alpha) is r=0.74. The validity of PST was investigated with regard to several criteria relevant in aviation psychology. Validity with respect to an external criterion (orientation, established on an instrument flight simulator) is R=0.56, with respect to an internal criterion (Eliot Price Spatial Test) r=0.64.

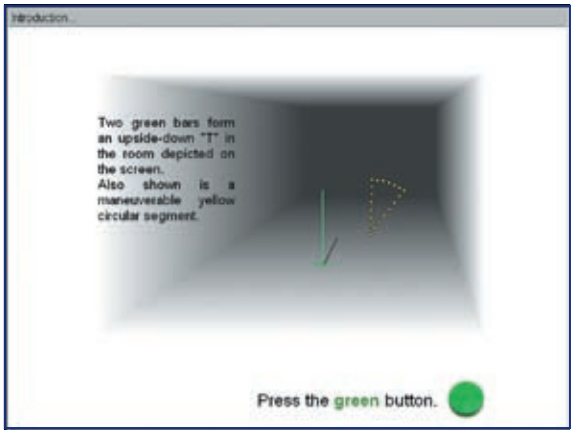


Psychomotor co-ordination

Psychomotor co-ordination can be defined as the capability to co-ordinate the movement of arms, hands and feet in response to visual stimuli.

SMK: Sensomotor Coordination

Movements are controlled through the use of sensor information coming from current activities. The necessary time to coordinate one's movements is essentially determined by the received and processed feedback information. Two completely separate constructs are assessed: the "Anticipative coordination ability" and the "Reactive coordination ability". The respondent's task is to correctly place the segment in two linear and one rotational axis and keep it in position. The test lasts 10 minutes. An internal consistency (Cronbach's Alpha) of 0.95 for the variable 'Time in ideal reange' was found. As a part of a test battery, that could correctly predict success in a flight simulator in 90% of the cases (corresponding to a validity coefficient of R=0.79), SMK contributed a relative relevance of 15% to the model.

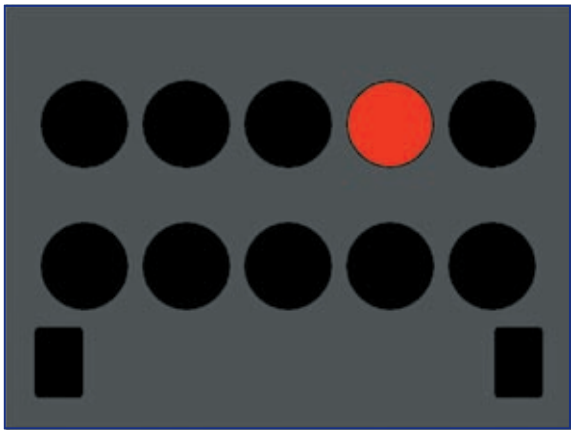


Choice Reaction Time

Choice reaction time can be defined as the interval between the onset of a stimulus (taken from a set of different stimuli) and the subjects correct response.

DT: Determination Test

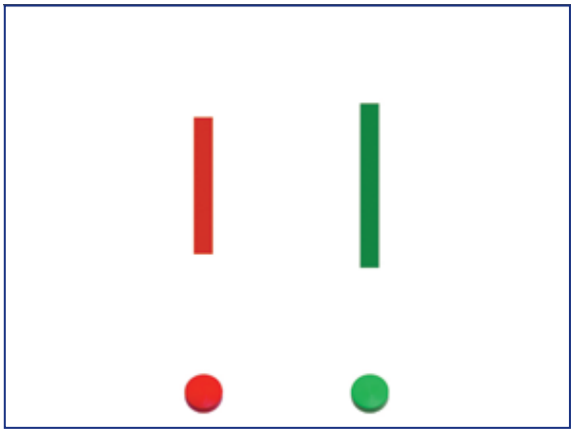
The test assesses reactive stress tolerance and reaction speed in multiple-stimulus-response situations. The DT requires the cognitive sub-skills of discrimination of colors and acoustic signals, memorization of relevant characteristics of stimulus configurations and response buttons as well as the assignment rules. The respondent is presented with visual or acoustic stimuli and reacts by pressing the appropriate buttons on the panel or stepping on the correct foot pedal. The test duration ranges from 6 – 15 minutes depending on the selected form. An internal consistency (Cronbach's Alpha) of 0.99 for the variable 'Correct' was found. As a part of a test battery, that could correctly predict success in a flight simulator in 90% of the cases (corresponding to a validity coefficient of R=0.79), the Determination Test contributed a relative relevance of 31% to the model.



Inspection time and Decision Making

Inspection time is the base line reaction time on simple dual-choice stimulus material

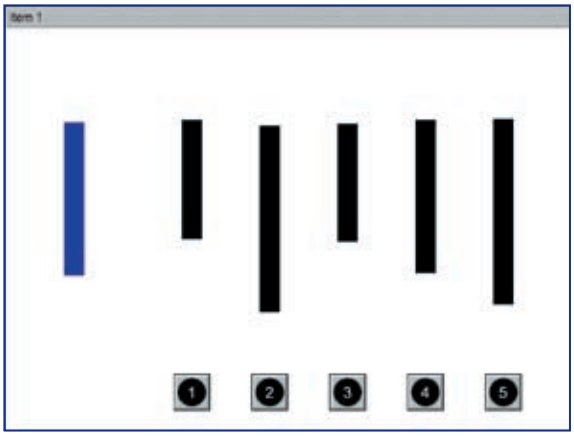
INSBAT: Subtest Inspection Time



This test follows the Inspection time (IT) paradigm (Vickers, 1970). Two stimuli are presented to the test person, which are either the same or unequal. Vickers presumes an intermittent process of the acquisition of information, which aims at a finding a decision. The regularities described here were examined and confirmed for a multiplicity of discrimination tasks and sensorial modalities. Likewise there are numerous indications of a medium strong negative correlation between general intelligence and the response times in inspection time testing. Correlations with verbal intelligence of r=-0.38 and with action intelligence of r=-0.74 (Nettlebeck, 1987) are reported. This test reaches a reliability (according to Cronbach) of a=0.94.

The capability to properly choose responses in complex situations where several reactions are possible.

INSBAT: Subtest Decision Quality and Speed



The operationalization of decision quality is based on the application of the signal detection theory. Based on the correctness and reaction times to visual discrimination tasks a measure of decision efficiency (efficient – inefficient), which is independent of working style, is determined by separating ability and working style (Häusler, 2004). At the same time, decision style (impulsive – reflexive), which is independent of ability, is being measured. After measuring the baseline inspection time (Vickers, 1970) for extremely simple length differentiation tasks, the respondent is confronted with more complex, ambiguous visual discrimination tasks.

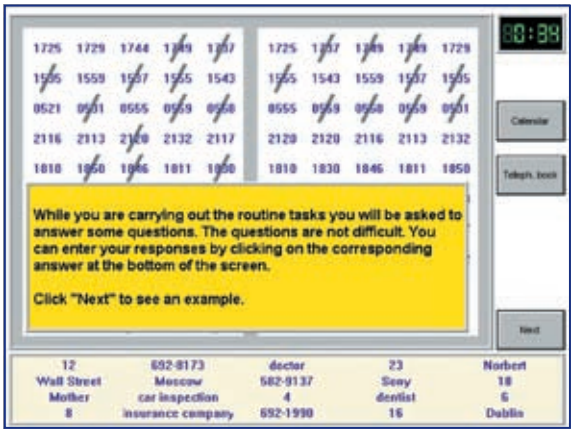
The challenge is to solve the tasks as quickly and correctly as possible. The reliability (Cronbach's Alpha) of the variable 'decision quality' is 0.90.

Multi-Task Ability

Multiple task abilities (time-sharing abilities) can be defined as abilities which are needed in situations where at least two independent tasks have to be performed simultaneously.

SIMKAP: Simultaneous Capacity/Multi-Tasking

Operationally SIMKAP is based on the definition of Simultaneous Capacity and Stress Tolerance. Simultaneous Capacity is defined as the performance achieved when simultaneously dealing with routine tasks and tasks demanding cognitive performances (problem solving). Stress Tolerance is defined as the extent to which performance differs when dealing with corresponding routine tasks under normal (baseline) and stress conditions. The task is to identify and mark critical items as fast and accurately as possible while simple problem solving is required. The reliability coefficients regarding the total performance for 'Simultaneous capacity' and 'Stress tolerance' vary between 0.94 and 0.97 and between 0.89 and 0.91 respectively.

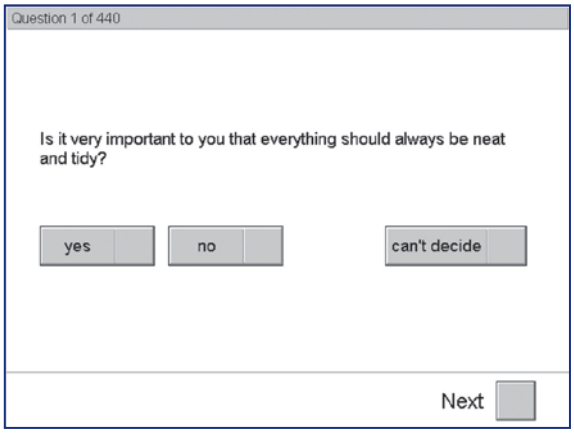


Personality factors

The personality factors which are important for the psychological evaluation of pilot applicants or license holders are presented below: Work orientation, social capabilities, and stress coping have to be considered, particularly in respect to crew resource management and crew co-ordination. Most of these traits are well known and can be measured by conventional questionnaires. The concept behind this trait-oriented assessment is that relatively stable dispositions are influencing behavior under various conditions in a typical way. All personality factors are assessed by using suitable subtests of the comprehensive personality structure inventory **Eysenck-Personality-Profiler-V6 (EPP6).**

EPP6: Eysenck-Personality-Profiler-V6

EPP6 is a multi-dimensional questionnaire based on Eysenck's personality theory. Due to the model's wide range of scales there is a set of three secondary stratum factors, namely Extraversion, Emotionality (Neuroticism) and Adventure (Psychoticism). For a more detailed view seven sub-scales for each of the factors exist. Furthermore, the questionnaire was expanded with an openness scale in order to detect faking attempts.
After a general instruction the test items are presented. The respondent enters his/her answers in a multiple choice answer format (yes / no / can't decide). It is possible to return to previous items and change the response.



The internal consistencies (Cronbach's Alpha) for the subscales vary between 0.61 and 0.84.

Language matrix

The **Expert System Aviation** currently is available in German, English and Czech. Contact us or one of our representatives if you should be interested in a conversion in another language. We constantly translate into different languages and extend our range of products.

The individual tests are available in the following languages:

	COG	DT	EPP6	INSBAT	PST	SIGNAL	SIMKAP	SMK	VIGIL
Arabic	X	X				X		X	X
Bulgarian	X				X	X		X	
Chinese	X	X	X			X		X	X
Croatian	X	X							
Czech	X	X		X	X	X			
Dutch	X	X		X	X	X	X	X	X
English	X	X	X	X	X	X	X	X	X
Finnish	X	X			X	X		X	X
French	X	X	X	X	X	X	X	X	X
German	X	X	X	X	X	X	X	X	X
Greek	X	X						X	X
Hindi	X	X	X			X			X
Hungarian	X	X		X		X	X	X	X
Italian	X	X	X		X	X	X	X	X
Polish							X		
Portuguese	X	X	X	X	X	X		X	X
Romanian	X	X				X		X	X
Russian	X	X	X	X			X		X
Serbien	X	X							
Slovakian	X	X			X			X	
Spanish	X	X	X		X	X		X	X
Swedish	X	X				X			X
Turkish	X	X				X			X

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February 2009

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- Display adapter with 24 or 32 bit color depth (16 millions colours)
- CD or DVD drive, hard disk, mouse, keyboard
- A USB - port (in case there are not enough USB-ports available a USB-hub with external power supply needs to be used)
- Network adapter (for networked Test Systems)
- Windows 2000/XP/2003/Vista (Windows NT4 on request)
- Internet-Explorer 5.5 or higher

Monitor

- CRT monitor (15" to 19") with a frame rate of at least 75 Hz or
- LCD flat-panel monitor (15" to 19") with a maximum of 16 msec. reaction time

Printer

- Any standard laser or ink-jet printer

Technical data

Universal Response Panel

- Seven colored buttons
- Ten numbered buttons
- One sensor button
- Two analog joysticks
- Two control knobs
- Foot pedals
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Power-supply via USB-port, max. 500mA.
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Geltungsbereich: *Scope:*	Forschung, Entwicklung, Fertigung, Verlag und Vertrieb von computergestützter psychologischer Diagnostik und kognitiver Rehabilitation Entwicklung, Produktion und Vertrieb von medizinischen elektrischen Geräten, im speziellen Biofeedback- und Reizstromgeräte *Research, development, production, editing and sales of computer assisted psychological diagnostics and cognitive rehabilitation* *Development, production and sales of electrical medical devices, in particular biofeedback- and stimulant current devices*
Normen: *Standards:*	EN ISO 13485:2003 Qualitätsmanagementsystem Medizinprodukte *Quality management system Medical devices*
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Contact:
Mr. Lauri Oksama
Rantatie 66
04310 Tuusula
Phone: 00358-9-181-62747
Mail: lauri.oksama@pvkk.inet.fi
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Mr. Lauri Oksama (aviation selection), Finnish Defence Forces:

We have nowadays 21 systems and they are used frequently in different civilian and military aviation selection procedures (pilot and air traffic control operators) in Finland. Originally, we become interested in VTS because we were looking for a user-friendly computerized testing system which includes standard widely used tests like Raven's matrices as well as some more special tests for aviation selection like psychomotor and attention tests. We chose VTS because it included both of these elements. As a computerized system VTS helps us a lot compared to traditional paper-and-pencil system; the test presentation and data collection is automatic etc. The company also develops new special tests, even very sophisticated adaptive ones based on the item-response- theory (e. g a spatial test called A3DW). We have a very good experience with VTS and we could recommend it for other.

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Austria:
SCHUHFRIED GmbH
Hyrtlstrasse 45
2340 Moedling
Phone +43 2236 42315
Fax: +43 2236 46597
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