

NATIONAL CENTRE FOR INFORMATION AND DOCUMENTATION

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# **ADVANCES IN BULGARIAN SCIENCE**



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## A GOOD DAY FOR INNOVATIONS IN EUROPE

*"The European Year is an effective way of helping to meet challenges by raising public awareness, disseminating information about good practices, stimulating education and research, creativity and innovation, and promoting policy debate and change. By combining action at Community, national, regional and local levels, it can generate synergies and help to focus policy debate on specific issues."*

*Yan Figel', Commissioner responsible for education and culture*

*Modern world attaches particular importance to a better use of knowledge and fast development of innovations. In a knowledge-based and multicultural society it is necessary to enlarge creative skills and knowledge, which will help people to be open for new ideas. Education and training are decisive factors for it.*

*Already in March 2007 the European Council underlined the role of education in acceleration of creativity, innovation and competitive power and introduced the notion "knowledge triangle": education, research, innovation.*

*To promote creative and innovative capacity the EC proposed the year 2009 to be **European Year of Creativity and Innovation**. The aim is to popularize abilities for creation and innovation as basic skills for everyone and to underline the key role of education as a basic support for innovation. Attention directed to competitive power, knowledge and skills within the context of the Lisbon Strategy can create conditions for good results of the European Year.*

*The policy of lifelong learning is an important instrument in support of this initiative. Policies in other fields will support its realization where necessary. It is good for the European Year of Creation and Innovation to attract enterprises, media, research, social and regional policy and development of rural regions.*

*Creativity is a condition without which innovation is impossible. New ideas and links between them are necessary for creation of new products, services, processes, strategies and organizations.*

*Innovation processes become more closely connected, multidisciplinary and problem-oriented and give rise to increasing demand for basic skills. From here the necessity of recognizing skills as "knowledge, skills and relations" springs up.*

*Motivation and initiativeness are among the main qualities on which the ability for creation and innovation is based. Organizational culture which supports openness and creativity is a vitally important precondition for successful education, creativity and innovation.*

*The European Year of Creativity and Innovation will generate a critical mass of activities directed to development of skills connected with creativity and innovation. It should comprise information campaigns, promotion of good practices, debates, meetings and conferences and foster a number of projects on local, national and European levels.*

*Activities in different spheres, such as business, media, convergence, development of rural regions directly or indirectly contribute to encouragement of creative and innovative abilities.*

*It is expected that the Year will have such a big impact as similar initiatives in the field of education – the European Year of Lifelong Learning (1996) and the European Year of Education through Sport (2004).*



# NACID

National Centre for Information and Documentation

## MAIN OBJECTIVES

NACID is a governmental institution affiliated to the Ministry of Education and Science. NACID collects, processes, maintains and disseminates reference and analytical information to support the national policy in the field of education, science and innovation as well as to support Bulgarian research bodies, individual researchers and SMEs. NACID is the Bulgarian ENIC-NARIC Centre.

## PRIMARY FIELDS OF ACTIVITIES:

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- Maintaining specialized databases of scientific production and research resources in Bulgaria.
- Providing information about national, European and trans-European research programs.
- Performing the functions of a National Centre for Academic Recognition and Mobility within the ENIC-NARIC network.
- Performing the role of institutional contact point of the Seventh Framework Program in Bulgaria.

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- "Scientific and Technical Publications in Bulgaria";
- "Register of the Scientific Degrees and Titles";
- "Who is Who in Bulgarian Science";
- "Papers".

### "Science and Industry" Databases

- "Partnership for Innovation and Development": Information about the national research units.
- "Knowledge for Innovations and Development" Information about Bulgarian R&D activities.

The information brokerage services are available upon request, providing access to over 1200 databases from major international commercial host centers, thus providing the research community with a wealth of S&T information.

- ☐ Library services in the field of science, technology, education and pedagogics.
  - Library collections - over 4 million items, including over 119 000 items of encyclopedias, monographs, reference books; over 13 000 items of bulgarian and foreign periodicals, serials; over 75 000 items of conference proceedings; over 10 000 items of dissertations, over 103 000 items of company profiles and product catalogues, over 13 000 items of UN report, over 600 reg. items of CD ROM, DVD etc.
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  - Online access to the library catalogues since 1980;
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## NATIONAL SCIENTIFIC PROGRAMMES WITH EUROPEAN DIMENSIONS

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### DEVELOPMENT OF FUNCTIONAL CHEESE STARTERS WITH PROVEN PRODUCTION OF BIOACTIVE PEPTIDES

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#### **Abstract**

*A total number of 210 strains of lactobacilli were isolated from different sources – home-made yoghurts and cheeses, plants and human fecal samples. The species affiliation of the strains was analyzed by Amplified Ribosomal DNA Restriction Analysis (ARDRA) followed by 16S rDNA sequencing. The strain differentiation was obtained by methods of Pulsed Field Gel Electrophoresis (PFGE) and Amplified Fragment Length Polymorphism (AFLP), which led to strain-specific genetic profiles. The general proteolytic activity for every strain was measured through derivatization of low-molecular weight peptide matter with ortho-phthalic aldehyde (OPA) and the strains with the best proteolytic activity were selected. Special peptidase activities were studied applying colored substrates. The ability of the selected strains to produce peptides possessing anti-hypertensive effect was evaluated by in-vitro screening for inhibition of Angiotensin Converting Enzyme (ACE). The strains with the best ACE inhibitory properties were subjected to further research of their anti-ACE peptides. Peptides with the strongest anti-ACE effect were purified and sequenced. In parallel the selected strains were screened for production of peptides with calcium and magnesium binding properties. Such peptides were isolated, purified and sequenced, too. Finally, two strains which were capable to produce bioactive peptides with the strongest anti-ACE and Ca- and Mg-binding activities were selected for development of cheese starters. After pilot*

*production of functional cheeses with the developed starters the two main functional effects were confirmed during the cheese ripening.*

#### **INTRODUCTION**

Milk proteins are precursors of many biologically different peptides. These peptides are inactive within the sequence of the precursor proteins but can be released by enzymatic proteolysis during milk fermentation. Milk protein-derived bioactive peptides may function as exogenous regulatory substances with hormone-like activity on the different intestinal and peripheral target sites of the mammalian organism. Food hormones such as bioactive peptides may be included in the formulas of physiologically functional foods and in industrial nutraceutical preparations [1]. To date, antihypertensive peptides, together with phosphopeptides and immunomodulating peptides, are the favorite bioactive peptides for application to foodstuffs formulated to prove specific health benefits [2].

Peptides are short chains of amino acids, which are snipped out of dietary protein by the action of the enzymes of the strains in the fermented products, but also those of the digestive system. Functional peptides display partial resistance to hydrolysis and can produce an effect either locally in the digestive tract, or elsewhere in the body, after passing through the circulatory system. There are four main fields in which the observed effect of consuming dairy products can be attributed to functional peptides: the digestive system, the body's defenses (anti-micro-

bial and immunomodulatory effects), the cardiovascular system (antihypertensive and antithrombotic effects), and the nervous system (opioid peptides). Another important functional effect is bone strengthening through improvement of mineral absorption [3].

Angiotensin-converting enzyme (ACE; EC 3.4.15.1) has been associated with the renin-angiotensin system which regulates peripheral blood pressure, where it catalyzes both the production of the vasoconstrictor angiotensin II and the inactivation of the vasodilator bradykinin. ACE inhibition results mainly in an antihypertensive effect but may also influence different regulatory systems involved in modulating blood pressure, immune defense, and nervous system activity [4]. Epidemiological studies suggest that consumption of fermented milk products is inversely related to the risk for hypertension. Several antihypertensive peptides that inhibit ACE have been isolated from milk products, and the ACE-inhibition activity of these peptides has been determined. The relation between ACE-inhibitory peptides and the chemical structure has not been confirmed, but it has been suggested that peptides with hydrophobic amino acids at the C-terminal position could be the most likely ACE inhibitors [5]. Peptides derived from casein by *L. helveticus* proteases have been shown to have ACE-inhibitory activities [6]. ACE-inhibitory activity of the casein-derived tripeptides Ile-Pro-Pro and Val-Pro-Pro has been shown in vitro [7].

Some bioactive peptides could have a potential effect on bone accretion by improvement of the absorption of calcium and magnesium through the intestinal barrier. These are mainly phosphopeptides with high binding capacity to calcium and magnesium [8]. It was reported that probiotic yogurt containing strains of *L. casei*, *L. reuteri*, and *L. gasseri* increased apparent calcium absorption bone mineral content in growing rats [9].

It is very important to note that the ability of lactic acid bacteria to release bioactive peptides is strain dependant. That's why it is necessary to screen a large number of strains in order to find good producers of peptides with functional properties. Additionally, the evaluated for probiotic effects strains must be very well characterized at genetic level in order to precisely know

their species affiliation and to derive their strain-specific genetic profiles.

In this study we screened a high number of Lactic acid bacteria strains for their ability to inhibit ACE and for their Ca-binding capacity. This is the first study of production of anti-ACE peptides and Ca-binding peptides in Bulgarian cheeses. We studied the influence of selected strains with anti-ACE and Ca-binding properties included in the starter on the development of functional peptides with such properties during the ripening of cheese.

## MATERIALS AND METHODS

### Assay of the total anti-ACE activity

ACE activity was determined by the method of Cushman and Cheung [10] modified by Nakamura et al. [11] with some additional modifications. After the milk fermentation with every evaluated strain the supernatant (5 ml, pH 4.3) was subjected to purification through reverse-phase cartridge (Waters C18ec). Following washing with water the peptides were eluted with 5 ml 60% acetonitrile in 0.1% trifluoroacetic acid (TFA). The eluate was freeze dried and reconstituted in 1 ml 0.1% TFA. The substrate Hip-His-Leu was dissolved in 100 mM Na-borate buffer (pH 8.3) to concentration in assay mixture of 6 mM. The final concentration of NaCl was 300 mM. To 190  $\mu$ l of substrate solution 20  $\mu$ l purified supernatant or peptide fraction were added and the reaction was initiated by 40  $\mu$ l of ACE enzyme solution (0.1 U/ml). The duration of the reaction was 30 minutes at 37°C until stopping with 100  $\mu$ l 4 M HCl. The extraction of liberated hipuric acid was performed with 1 ml ethyl acetate. After evaporation of the extractant and reconstitution with 1 ml of water the concentration of hipuric acid was determined at 228 nm. The percent of inhibition was calculated by the formula  $(B-A)/(B-C)*100$ , where A is optical density in both ACE and the peptide fraction, B is optical density without the peptide fraction, and C is optical density without ACE. The concentration of an ACE inhibitor needed to inhibit 50% of ACE activity is defined as the 50% inhibitory concentration ( $IC_{50}$ ).

### Purification and sequencing of inhibitory peptides

The supernatants were partially purified on



reverse-phase cartridges as previously explained and subjected to centrifugal ultrafiltration with membrane 5000 Da. TFA was added to the samples to 0.1% concentration and 1 ml was injected onto RP-HPLC column Nucleosil C18. The gradient from 0% to 80% acetonitrile in 0.1% TFA was conducted for 45 minutes. Peptides were detected at 210 nm by means of UV-detector (Shimadzu) and 1 ml fractions were collected. These fractions were freeze dried and evaluated for anti-ACE activity. The fractions demonstrating the highest ACE inhibitory activity were refractionated on HPLC column Nucleodur Sphinx at specific gradient conditions for the respective fractions. For instance, the fraction from *L. helveticus* A1 was rechromatographed at 25%-35% acetonitrile, and the fraction from *L. casei* 3 – at 35%-45%. The last purification step was performed by means of ion-exchange HPLC column Shimadzu SCX containing benzene-sulfonic cation exchange groups in Li mode. The elution was performed through gradient of pH 3.0 to 9.0 in citrate buffers. Finally, single peaks with ACE inhibitory activities were collected from the three strains demonstrated the highest total anti-ACE effect.

Before sequencing the amino acid content of the purified ACE inhibitory peptides was determined after hydrolysis with 4 M methanesulphonic acid and derivatization with phenylisothiocyanate. Initial step for the sequencing was the fixing of the C-end of peptides to arylamine-PVDF membrane as explained by the producer (Millipore, USA). The sequencing from the N-end of the peptides was performed according to Edman.

#### **Determination of total Ca-binding activity through ion-selective electrode**

The samples were deproteinized and demineralized as it was previously explained. The purified samples were buffered with Tris-HCl, pH 8.0 to final concentration of 50 mM and to 10 ml of samples 100  $\mu$ l 0.1 M  $\text{CaCl}_2$  was added. After mixing for 1 minute the  $\text{Ca}^{2+}$  concentration was measured by means of  $\text{Ca}^{2+}$  selective electrode (Orion 93-20, Boston MA) connected to ion analyzer Orion 290A. The calibration curve ( $\text{mV}/\text{Ca}^{2+}$ ) with standard  $\text{Ca}^{2+}$  solutions was built. The calcium bonded by the peptides was

determined after subtraction of the measured free calcium from the total calcium.

#### **Purification of Ca-binding peptides from cultures with the highest Ca-binding activity**

The supernatants from the ten strains with the highest Ca-binding activity were ultrafiltered through 5000 Da membrane and subsequently loaded onto RP-cartridges Chromabond HLB. After washing with water the peptides were eluted with 60% acetonitrile in 0.1% TFA. After evaporation of the eluent the substances were reconstituted in 1 ml 10% acetonitrile in 0.1% TFA. The solution was injected onto RP-HPLC column Hypersil peptide (Macherey-Nagel). Using Shimadzu HPLC system 1 ml fractions were collected. The eluents were: Eluent 1 (0.1% TFA in water) and eluent 2 (80% acetonitrile in 0.1% TFA). The gradient of eluent 2 was from 2% to 60% for 45 minutes at 40°C and flow rate of 1 ml/min. The fractions with the best Ca-binding activity were rechromatographed using cation-exchange column BioBasic-300. The used eluents were: Eluent A (20mM  $\text{KH}_2\text{PO}_4$ , pH 4.8) and Eluent B (NaAcetate in 25% acetonitrile) at 40°C and flow of 1 ml/min. The gradient of Eluent B was from 0% to 60% for 15 minutes. All fractions collected after ion-exchange purification were evaluated for their Ca-binding activity. The fractions with the best Ca-binding activity were freeze dried and subsequently the corresponding peptides were sequenced as it was explained previously.

### **RESULTS AND DISCUSSION**

In the present work 200 strains of lactic acid bacteria from different sources were evaluated for their ability to produce bioactive peptides with anti-ACE and Ca-binding effects. The initial screening was made according to the total ACE inhibitory and Ca-binding activities. On Table 1 the twenty strains with the best anti-ACE activity and their corresponded Ca-binding activity are shown. According to our results the strains demonstrating the highest ACE inhibitory activity possessed the best proteolytic activity, also. Among these strains the best producers of Ca-binding peptides were found. The two strains demonstrating the highest ACE-inhibitory activity show the best Ca-binding activity. The strain with the strongest ACE inhibition is *L. helveticus*

A1, and the same strain shows the second Ca-binding activity (6.08 mM/ ml bonded Ca). This strain possesses good technological properties as fair acidification, production of aroma compounds and proteolytic activity. *L. helveticus* A1 is one of the best candidates for development of cheese starters. It was proved that addition of this strain to main compounds in cheese starters *L. bulgaricus* and *S. thermophilus* leads to release of much bigger quantity of bioactive peptides with ACE-inhibitory and Ca-binding activities. The strain showing the second anti-ACE effect is *L. casei* C3. The same strain is the best producer of Ca-binding peptides. As a single strain the acidification activity of this strain is low, but if it is

combined with *Lc. lactis* with good acidification activity, *L. casei* C3 is very appropriate to be included in cheese starters. It should be noted that this strain grows in cheese conditions during the first three weeks of the ripening process (data not shown). Another important result from the study of the total anti-ACE and Ca-binding activities is the registration of these activities of one *L. bulgaricus* strain (*L. bulgaricus* 1054). It is a very rare case such fair values of the two bioactivities to be possessed by a strain of this species.

One of the main tasks of this study was purification of the bioactive peptides with the best anti-ACE and Ca-binding functions. On Figure 1

**Table 1.** Anti-ACE and Ca-binding activities of the 20 strains with the strongest bioactivity

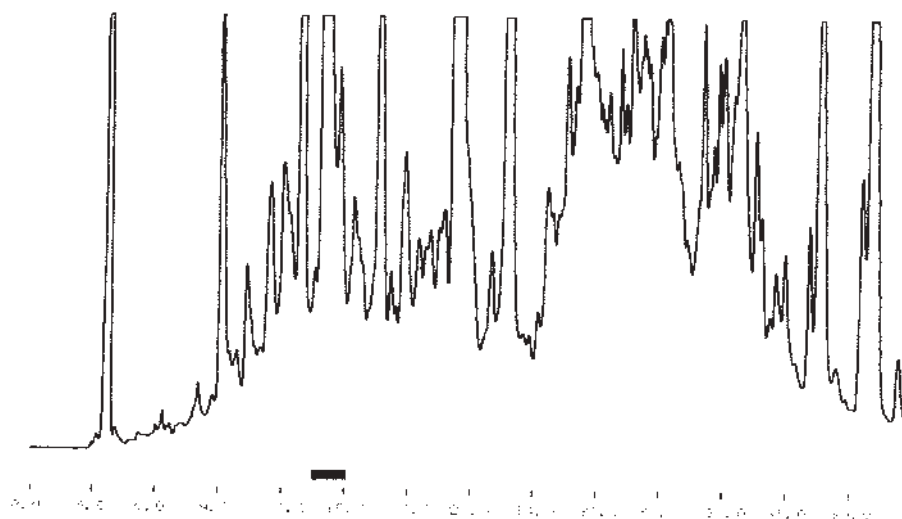
Nº	Strain	ACE inhibitory activity, %	Bonded Ca mM/ ml at 10 mM total Ca
1	<i>L. lactis</i> 1	58.4	1.88
2	<i>L. lactis</i> 3	3.1	0.21
3	<i>L. lactis</i> 4	3.0	0.15
4	<i>L. lactis</i> 6	7.2	0.1
5	<i>L. lactis</i> 7	9.0	0.04
6	<i>L. lactis</i> 10	8.7	0.09
7	<i>L. helveticus</i> 4	14.2	1.64
8	<i>L. helveticus</i> 7	12.2	2.08
9	<i>L. helveticus</i> 8	60.1	2.64
10	<i>L. plantarum</i> 2	13.2	0.2
11	<i>L. helveticus</i> A1	94.0	6.08
12	<i>L. casei</i> 1	7.8	2.8
13	<i>L. casei</i> C3	82.1	6.4
14	<i>L. casei</i> 4	38.2	4.08
15	<i>L. salivarius</i> 3	3.5	0.1
16	<i>L. helveticus</i> Hh	34.0	4.32
17	<i>L. helveticus</i> V28	68.2	4.96
18	<i>L. helveticus</i> Q40	11.8	2.56
19	<i>L. helveticus</i> 48	9.3	3.48
20	<i>L. bulgaricus</i> 1054	36.5	3.48

**Table 2.** Sequences of peptides with ACE-inhibitory and Ca-binding effects from the strains with the highest bioactivity (*L. helveticus* A1 and *L. casei* C3) and the strain *L. bulgaricus* 1054

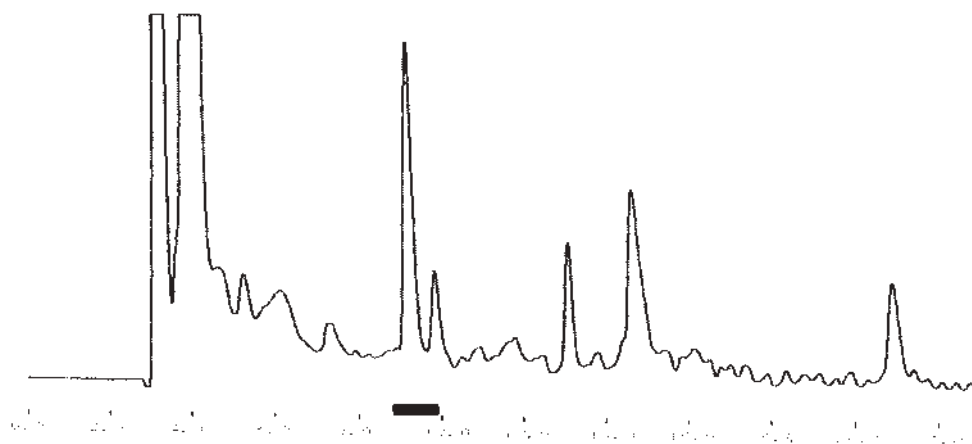
Strain	Sequence of anti-ACE peptides	Sequence of Ca-binding peptides	Source
<i>L. helveticus</i> A1	Ala-Leu-Pro-Met	QMEAES <sub>p</sub> IS <sub>p</sub> S <sub>p</sub> S <sub>p</sub> EE	f 59-70 $\alpha_{s1}$ -casein
<i>L. casei</i> C3	Ala-Pro-Phe-Ala-Lys	S <sub>p</sub> LS <sub>p</sub> S <sub>p</sub> S <sub>p</sub> E	f 15-20 $\beta$ -casein
<i>L. bulgaricus</i> 1054	Leu-Gly-Pro-Val-Arg-Gly-Pro-Phe-Pro	VNELSKDIGS <sub>p</sub> ES <sub>p</sub> TEDQAMEDIK	f 37-58 $\alpha_{s1}$ -casein

crude separation of the initially purified peptides is shown as it was explained in the methods. The fraction with the best ACE-inhibitory activity is underlined. The same fraction was subjected to additional fine refractationing using again RP-

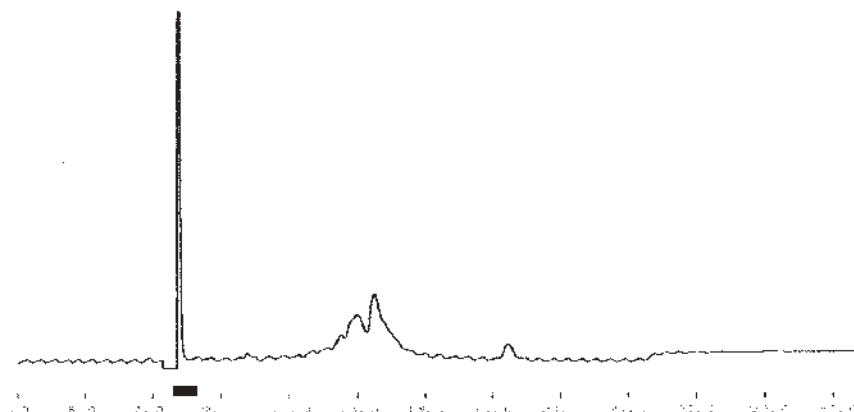
HPLC separation but with specially adjusted gradient program. The corresponded chromatogram is shown on Figure 2. The fraction with the strongest ACE-inhibitory effect is underlined, too. The final purification step of this fraction is ion-



**Fig. 1.** Crude fractionating of peptides released by strain *L. helveticus* A1



**Fig. 2.** Reverse phase refractationing of the most active fraction received after the crude fractionating



**Fig. 3.** Ion-exchange purification of the anti-ACE single peptide from *L. helveticus* A1

exchange using pH gradient. This different principle of separation comparing with the reverse phase helps to receive well purified single peptides. The chromatogram after ion-exchange separation is shown on Figure 3 and again the fraction (single peptide) is underlined. Single peptides with the strongest anti-ACE effect were purified from the ten strains which demonstrated the strongest total ACE inhibition. The ACE-inhibitory activity of the single peptides was proved using the modified test which is explained in the methods.

Usually bioactive peptides with Ca-binding activity and especially with anti-ACE activity are small peptides. In order to analyze the molecular structure of bioactive peptides the common Edman sequencing in solution is not suitable, because the derivatizing reagent – phenylisothiocyanate cannot be separated by extraction from the small peptides. That's why we bonded these peptides onto the membrane through arylamine connection. In this case the C-end remained connected during the sequencing steps. The sequences of the peptides with the strongest anti-ACE and Ca-binding properties are given in Table 2. In the case of *L. helveticus* A1 the peptide contains four amino acid residues, and in case of *L. casei* C3 – five amino acids. The most studied peptides Val-Pro-Pro and Ile-Pro-Pro were found in the supernatants from *L. helveticus* A1 and *L. helveticus* V28, but their quantity was very low and did not lead to prominent ACE inhibition. Concerning the peptides with Ca-binding effect, as it was expected they are mainly phospho-peptides. Three amino acid residues could be phosphorylated: serine, threonine and tyrosine. In the present study we found only phosphoserine is involved in Ca-binding. The main source of bioactive peptides with Ca-binding activity in the present research was  $\beta$ -casein and  $\alpha$ S<sub>1</sub>-casein. These two casein fractions are subjected to proteolytic attacks during ripening of the cheeses much more than other fractions. The release of such small bioactive peptides as these with ACE-inhibitory and Ca-binding effects is in parallel with a strong proteolytic activity of the strains. The technological conditions as the ripening tem-

perature and the duration of cheese maturation are of importance for the necessary break-down of the casein fractions by the proteolytic enzymes and for release of sufficient quantity of bioactive peptides.

## CONCLUSIONS

The ability of lactic acid bacteria to release bioactive peptides is strain specific and is dependant of dairy processing conditions. In the present study we found two strains with strong ACE-inhibitory and Ca-binding effects. The addition of such strains into the cheese starters will lead to production of bioactive peptides in cheese products. In this way it is possible to increase functional properties of the national Bulgarian cheeses – white brined cheese and kashkaval.

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## SUPERIOR TECHNOLOGY MODERNIZING THE CASTING PROCESS IN DENTISTRY

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### **Abstract**

*In reference to the fact that our company is highly experienced in machinery and high frequency generators development, we used our know how to invent a machine for investment casting. The device is able to cast all kinds of metals – precious and non-precious, including titanium, under vacuum/argon atmosphere. The technology does not use crucibles or metal rings. It prevents waste of metal, while as the results show, in centrifugal casting some amount of metal is lost. Pressure injection casting provides precise, fast and repeatable casting with no losses.*

*Today, titanium and titanium alloys are used for the fabrication of prosthetic joints, surgical splints, stents and fasteners, dental implants, dental crowns and partial denture frameworks [4]. Since titanium castings have been used in the field of medicine and dentistry, we have been filling the niche in this area. Thus we assist with our high-tech equipment in the rapid development of one of the most progressive technologies. Accordingly, we take part in the evolution growth of medicine, particularly Dentistry.*

### **INTRODUCTION**

Almost all existing dental casting machines are based on the oldest and well-known technology for casting called "INVESTMENT CASTING" or "LOST-WAX CASTING".

According to the literature and manufacturing of this type of equipment, we could classify them in the following way:

- according to the way of heating the metal: induction and ARC heating;
- according to the way of casting the metal: centrifugal, pressure casting and counter-pres-

sure casting method.

Our machine UltraCast Enterprise is designed and developed on the basis of the most up-to-date and modern technologies for induction heating and pressure casting. Our engineers used the latest achievements in the field of semiconductor technology and advanced approach for development of inverters [3]. The system is with water cooling. Also there is an option with built-in water cooling system. What's more, the system casts titanium.

Titanium was discovered in 1791. It is the ninth most abundant element in the earth's crust (Table 1) [2]. Pure titanium was first produced by M. Hunter, in 1910. The main advantages of titanium are low density ( $4500 \text{ kg/m}^3$ ) compared to steel ( $7800 \text{ kg/m}^3$ ), good corrosion resistance (it is inert to body fluids) and high strength (depending upon alloying). It is two times lighter than Co Cr alloys, which are the most widely used in medicine so far. It is not magnetic, also highly resistant to aggressive chemical environment. It is the only material which doesn't lose its merits after thermal and mechanical treatment. This is the most biocompatible material and the lightest metal used in prostheses for the human body. Recently, many materials have been replaced by titanium.

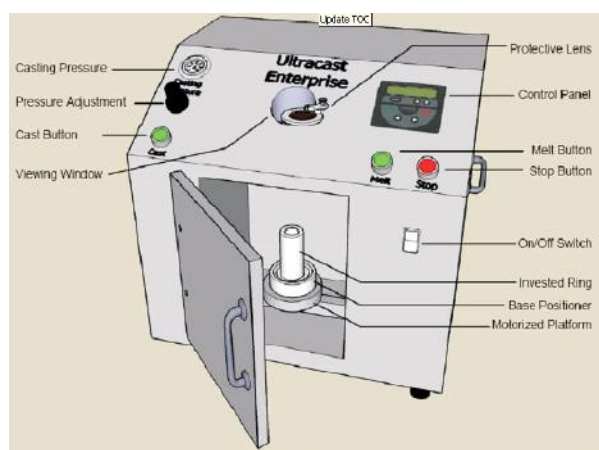
The fact that titanium is a reactive metal makes up a difficulty in manufacturing the components out of it. Particularly at high temperatures it absorbs oxygen and nitrogen from the atmosphere [5]. The absorption of small amounts (20ppm) causes a reduction in fatigue strength. Hence where parts are manufactured by casting or welding, the environment must be purged with an inert gas, argon is normally used.

**Table 1.** The 10 Most Abundant Elements in the Earth's Crust

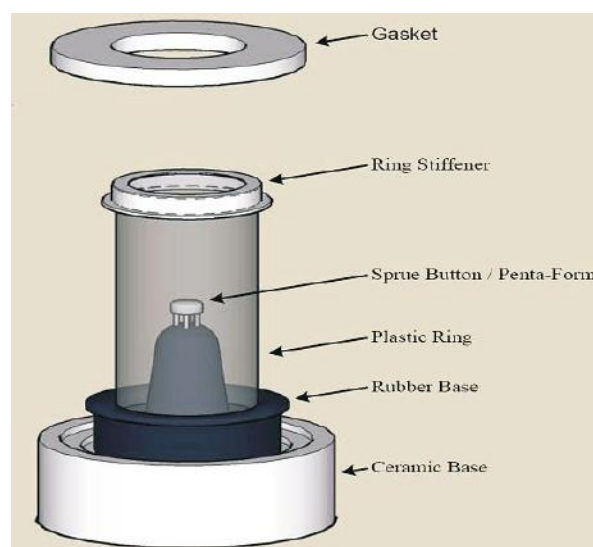
Element	Abundance percent by weight	Abundance parts per million by weight
Oxygen	46.1%	461,000
Silicon	28.2%	282,000
Aluminum	8.23%	82,300
Iron	5.63%	56,300
Calcium	4.15%	41,500
Sodium	2.36%	23,600
Magnesium	2.33%	23,300
Potassium	2.09%	20,900
Titanium	0.565%	5,650
Hydrogen	0.14%	1,400

Also the surfaces of Ti investment castings are contaminated with oxygen because of reaction with the oxide mold material. This brittle surface layer called alpha case must be removed

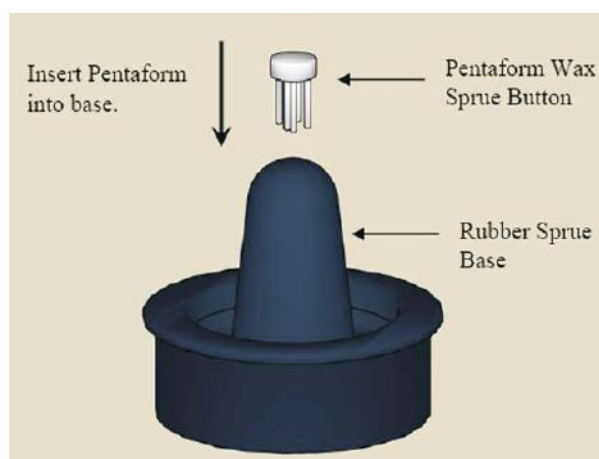
before use. Prediction of the thickness of the contaminated layer would allow modification of mold design and gating to reduce the alpha case. It would also provide a proper estimate of



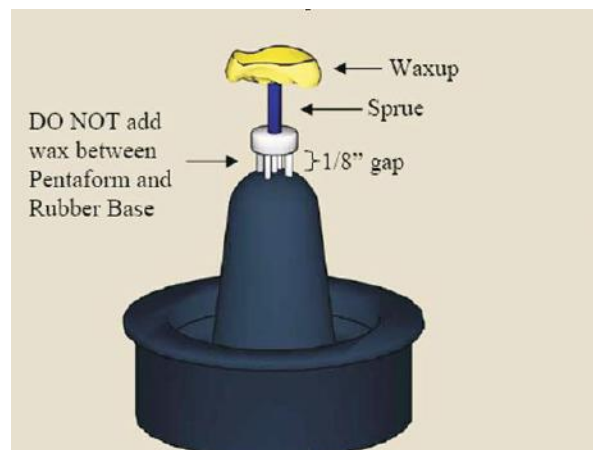
**Fig. 1**



**Fig. 2**



**Fig. 3**



**Fig. 4**



the extra dimension to be added to the casting to allow for alpha case removal [1].

These facts made us invent a system with vacuum/argon atmosphere for casting all metals, including titanium. Our technology does not use crucibles or metal rings and casts without centrifugal force. No centrifugal force means no loss of metal, which is due to unavoidably pillage of metal during centrifugal casting.

## MATERIALS AND METHODS

The common view of proposed casting machine is shown on (Fig. 1). It is designed for dentistry. High frequency induction heating and pressure casting methods are implemented. The Enterprise UltraCast is an advanced yet simple dental/jewellery casting machine. In all present system on the market of that kind – induction and pressure – there are two separate details – crucible and mould. The unique design of ULTRACAST eliminates the need for crucibles by incorporating the crucibles' function into the INVESTED RING (Fig. 1). The investment ring is totally produced by investment material. In this way the end customer saves the expenses for crucibles. The volume of the spruing is decreased, which leads to decreasing the amount of the needed metal. There is no loss of metal typical for centrifugal casting machines.

The heating is done quickly and safely via high frequency induction heating. The Enterprise UltraCast can heat all metals, including titanium, to temperatures exceeding 3400°F /1800°C/.

## SPRUING

Spruing for the Enterprise UltraCast is not more different than spruing for all other casting systems – with one exception: all sprues must be attached to a "Pentaform" wax sprue button and must be as short as possible.

Pentaform must be pressed into rubber base as far as it will go (Fig. 3). The Pentaform will not go all the way down. There must be a minimum of 1/8" gap between the bottom of the Pentaform wax sprue button and the top of the rubber sprue base. The wax doesn't have to be added between the Pentaform and the rubber base.

Place a Pentaform on the rubber sprue base first (Fig. 3), and then attach your wax up with the sprue(s) to the Pentaform (Fig. 4).

## PROCESS

The casting process may be divided in three phases: preparation, melting and casting.

The preparation is a process of creating appropriate conditions, which allow the melting to be provided without oxidation and minimum levels of slag. This guarantees the minimum loss of metal and increases the quality of the castings. In most of the existing casting machines there is no preparation process and the casting is realized in air ambience. In UltraCast Enterprise the preparation process includes making of a vacuum camera, which is filled in with low pressure argon and vacuum several times to insure there is no oxygen present during melting. This is extremely important while casting titanium and titanium alloys.

The second phase is melting of the metal. In this phase UltraCast has three possibilities – melting in air ambience and ambient pressure, melting in inert gas and low over pressure and melting in vacuum. Melting under inert gas has undoubted benefits and is recommended regardless of the melting material. The powerful high frequency generator allows the metal to be melted fast. The effective volume of the crucible is about 20 cm<sup>3</sup>, which alloys melting at once 90 g titanium, 150 g chrome-nickel alloys and about 300 g precious alloys. For example 60 g of chrome-nickel alloy is melted for 55 sec, and 20 g of titanium for 45 sec.

The third phase of the process is casting. When the metal is melted the operator presses the button "Cast" and starts the casting phase. The phase ends when the preliminary set casting time is over or when the operator presses the "STOP" button.

## APPLICATIONS

This advanced device is widely used in the dental laboratories for making bridges, crowns and dental implants, as it is shown on (Fig. 5). It can be applied also in jewellery industry and production of medical implants.



Fig. 5



## CONCLUSION

Since Ultracast Enterprise can be modified for different applications, there are possibilities for significant increase in the production of high frequency induction heating casting machines.

The technical advantages of our casting machine are uncontested. It was proved by the huge interest during a dental exhibition we participated in. We got orders from countries such as Romania, Serbia, Turkey, Greece and Bulgaria. So far, 6 systems have been sold in the USA and we have orders for another 30.

Based on these findings we can summarize that our machine hopes to be involving the so-called high technology, which could become a factor for development of metal casting in the future.

The main advantages of the new product are:

- 100% Solid State Power Supply;
- cast all metals including Titanium, Precious and Non-Precious;
- vacuum / argon atmosphere prevents oxidation;
- no vibrations;
- simplified mechanics which don't need balancing;
- possibilities for controlling of environment during the melt and cast phases;

- optional self-cooling system;
- the process does not require Crucibles or Rings;
- no Centrifugal Force — No lost metal;
- reliable modular system, easy to maintain and service;
- easy to install and simple to operate;
- durable and compact system.

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## BULGARIAN ADDED VALUE TO ERA

### GOOD PRACTICES FOR TOTAL QUALITY MANAGEMENT APPROACH IN "OPTIX" Co. – BULGARIA

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Is it possible to combine successfully an Integrated Management System which includes 5 international standards with Japanese practices for Total Quality Management? "OPTIX" company gives an affirmative answer. Recently "OPTIX" Co. received the first in Bulgaria Japanese award for quality - "Bosei" (striving for the stars). This prize was established by the Japanese International Cooperation Agency (JICA) and Tokay University in Japan. A special commission assessed the effectiveness of applied practices of Total Quality Management (TQM) in the production of "OPTIX" and awarded the company.

For more than a year "OPTIX" successfully combines a variety of international standards - ISO 9001:2000, ISO 14001:2004, OHSAS 18001:1999, ISO 27001:2005 и NATO AQAP 2110 and a set of "Kaizen" activities.

In 2003 together with the Japanese Center for productivity "OPTIX" started several internal corporate trainings and practical exercises for "Increasing productivity in the enterprise", introducing "Kaizen" practices such as "5S".

„5S" is a shortening from the 5 Japanese words Seiri, Seiton, Seison, Seiketsu and Shitsuke and it means a system of effective methods for organizing labor and working place.

Translated into English the five S mean: sorting, arrangement, cleaning, standardizing, prevention.

Two years later, using as a model the Japanese system for a total quality management, the company started also the so-called "Quality Cir-

cles". These are small groups of employees in company with similar responsibilities which main goals are:

- To identify the problems faced in everyday work;
- To analyze the causes of these problems;
- To find adequate and rational solutions;
- To create mechanisms for prevention of these problems.

Three years after the start of these workshops the positive effects are:

- o An improved communication between the management of "OPTIX" and the employees in both directions;
- o Awareness and ambition for improvement and self-improvement;
- o Increased motivation and personnel commitment;
- o Building a permanent trust in the company and its products.

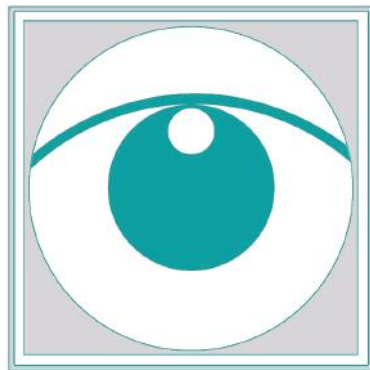
In 2007 "OPTIX" became the first company in Bulgaria and one of the first organizations in Europe, which implemented successfully fivefold integrated management system that includes the following international standards:

- ISO 9001:2000 - Quality management;
- ISO 27001:2005 - Information Security;
- ISO 14001:2004 - Environmental Protection;
- AQAP 2110 - Military standards of NATO;
- OHSAS 18001:1999 - Health and Safety at Work.

All processes in "OPTIX" are organized and

described in this integrated system in accordance with international standards and specifications.

After one year of co-existence between the Integrated System and the Total Quality Management practices the analysis shows that both approaches are fully compatible and complementary within the company.



**"OPTIX" Co. -  
A DIFFERENT REALITY**

ters are located on 8000 sq. m facilities in the town of Panagyurishte. The company has also production premises for conventional optics fabrication in Popintzi. Today "OPTIX" has more than 360 employees - graduated specialists and technicians experienced in optical design and production. The company has two sales subsidi-



"OPTIX" Co. is a contemporary enterprise with a completely closed production cycle. Founded in 1998 as a 100% private organization, the company quickly established a reputation for designing, manufacturing and testing of quality optical components and assemblies, optomechanical and optoelectronic systems for civil and defense applications. The corporate headquar-

aries registered in Germany and UK, main object of which is to keep a close contact with the customers and to provide the needed technical and marketing support services.

In 2004 "OPTIX" established a JVC with two leading German medical companies and started production of rigid and flexible endoscopes. It put Bulgaria on the high-technology map as the 9th country in the world to produce endoscopic systems.

In three consecutive years - 2005, 2006 and 2007 - "OPTIX" was awarded with the prize "Innovative Enterprise of the Year". In 2006 the company also won "Investor of the Year" competition held by the "InvestBulgaria Agency" in the category "Investor in the area of innovative high tech-





nologies". In 2008 the company was awarded the Grand Prize of the Bulgarian Industrial Association for contribution to the National economy. In 2008, "OPTIX" became the first company to receive the Japanese Quality Award "Bosei".



Due to its cutting-edge technologies and updated optical and mechanical design software, "OPTIX" Co. is able to complete the whole production cycle - from the development stage and prototype manufacturing to serial production of parts, assemblies and devices.

The company has an integrated CAD/CAM system and a complete ERP system for management of all operational levels - production, deliveries, sales, finance and accounting.



"OPTIX" Co. is the only Bulgarian company, which completely manufactures professional and cost-effective optical equipment for the Army and Police forces:

- Night vision goggles and binoculars;
- Day and Night sights for small arms;
- Day/night security systems and equipment;
- Mobile Thermal systems;
- Completely integrated surveillance systems.

"OPTIX" is awarded the manufacturer/supplier NCAGE code 0001BU in the NATO codification system.

The Bulgarian piece keeping troops overseas are equipped with compact and durable on most severe weather conditions night vision devices, developed and produced by "OPTIX" Co. The



company won a variety of tenders in consortium with "FLIR" for supply of high-tech thermal vision mobile systems for patrol and control of the Bulgarian national border.

"OPTIX" participates traditionally in a number

of international exhibitions and fairs, showing products for different applications in the field of medical care, optics, military industry, such as EUROSATORY – Paris, France; DSEI- London, UK; DEFENDORY- Athens, Greece; IDEF- Istanbul, Turkey; IDEX - UAE; DSA- Kuala Lumpur, Malaysia; HEMUS – Plovdiv, Bulgaria; ANTITEROR - Sofia, Bulgaria; OPTATEC – Frankfurt, Germany; LASER – Munich, Germany; PHOTONICS WEST – San Jose, USA; OPTIFAB – Rochester, USA etc. At such big international forums "OPTIX" has the opportunity to present its own products to the international community and to affirm the company's positive international image.

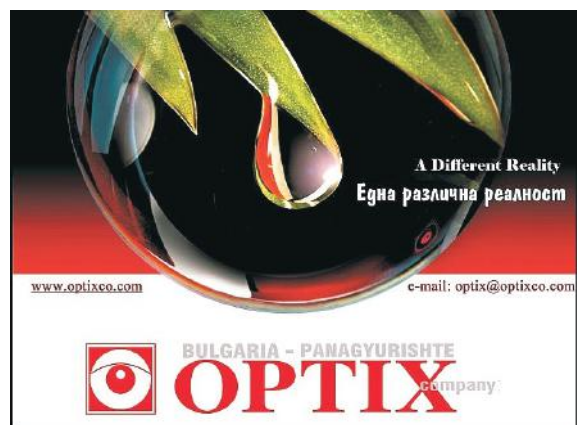
"OPTIX" Co. participates in a wide number of



exhibitions such as "Photonics West" (San Jose, USA), "LASER" (Munich, Germany), "IDEX" (Abu Dhabi, UAE), "EUROSATORY" (Paris, France), DSEI (London, UK), OPTIFAB (Rochester, USA), "DEFENDORY" (Athens, Greece), "IDEF" (Istanbul, Turkey), "OPTATEK" (Frankfurt, Germany), "NightVision" (Washington, USA), "DSA" (Kuala Lumpur, Malaysia), "LAAD" (Rio de Janeiro, Brazil).

**"OPTIX" Co. main strengths are:**

- High-quality products which completely



conform to the requirements of the European and World standards;

- Continuous improvement of the production capabilities and introduction of new cutting-edge technologies;
- Expanding the core of the company business expertise;
- Improvement of the available measuring equipment and labs;
- Enhancing the motivation and professional competence of the personnel.

"OPTIX" Co. invests in competence and professionalism on all levels!

#### **THE INTEGRATED MANAGEMENT SYSTEM IN "OPTIX"**

"OPTIX" is one of the first organizations in Europe, which **implemented successfully five-fold integrated management system** that includes the following international standards:

- ISO 9001:2000 – Quality management
- ISO 27001:2005 – Information Security
- ISO 14001:2004 – Environmental Protection
- NATO AQAP 2110 – Military standards of NATO
- OHSAS 18001:1999 – Health and Safety at Work

In general, a **Management system** consists of a good organizational structure with clearly defined responsibilities and internal corporate relations, precise planning and documentation of all processes in the organization, providing quality resources, infrastructure and human capital, maintaining a permanent feedback, analysis and improvement processes aiming to effectively achieve the initial goals.

Management systems are a major factor for the prosperity of a company. These are important not only for increasing competitiveness. Management systems are responsible for reducing production costs, increasing productivity at a reduced cost, increasing profits and eliminating inefficient business processes.

#### **How?**

This ambitious project was a challenge for the company itself, the consultants from „Bulecoprojects“ Ltd. and the certifying organization TÜF NORD CERD GmbH.

The key to the successful implementation of the integrated management system was on one

hand the experience of "OPTIX" in managing quality systems dating back to 2002, and on the other - the self-awareness and responsibility of every single employee. The company was re-certified for ISO 9001:2000 in April 2005, and in order to meet the specific requirements of all NATO forces in executing the contracts for the supply of military and special production, one year after the recognition of Bulgaria as a full member of NATO in April 2004 "OPTIX" implemented a quality management system in accordance with NATO's Allied publication AQAP-2110.

#### **Why?**

Consistently following the corporate strategy for continuous development, improvement of business processes, keeping and increasing the trust of business partners, meeting customers' requirements and complying with the realities of modern life, "OPTIX" pays particular attention to the information security issues, environmental protection and safe and healthy working conditions.

The company management is aware that in today's dynamic world those organizations that possess reliable and timely information always get an advantage. Information management is of a critical importance for the company's inner processes and "OPTIX" competitiveness, which is directly related to meeting the requirements in the Allied publication on quality assurance NATO AQAP 2110. Therefore the Information Security ISO 27001:2005 standard is seen as a solid and prestigious proof of the organization's ability to protect information assets.

Being aware of the fact that **quality has no alternative** and that **the heart of any company are its employees, the management formulated the following mission of "OPTIX"**:

**"To design and produce high quality products in the field of optics, mechanics and electronics, to provide our customers the best solutions for their needs, using innovative approaches and the long experience of our employees. To make "OPTIX" a synonymous for „precision and quality at a reasonable price“. To provide the collective team pleasant working conditions and decent life".**

Those who have no objectives cannot find the way to achieve them.

## **THE TOTAL QUALITY MANAGEMENT "TQM" PRACTICES IN "OPTIX" QUALITY WORKSHOPS**

### **The essence of the quality workshops**

The quality workshops bring together small groups of employees from a certain company that share similar responsibilities. They aim to improve the performance and organizational environment. Based on the similarity in their duties, the participants of each workshop organize in accordance to their current interests and try to find, investigate, analyze and solve problems related to their daily work.

Experience has repeatedly shown that efforts put only by the management are totally insufficient to achieve long-lasting success. Only the efforts of all employees and their commitment to the organization may lead to long-lasting and effective quality rising not only regarding to the final products, but for the atmosphere in the company.

### **What are the outcomes from the quality workshops?**

Programs based on the quality workshops are being implemented for several reasons, but the main result which usually occurs as a consequence, is increasing of the quality and level of services that a company may offer. The activities during the workshops usually lead to revealing all the mistakes and obstructions to good practices and thus enhance the pleasure of working process, contributing to the satisfaction of the tasks done. This inevitably leads to manufacturing products of higher quality and the desire for continuous, constant improvement (Kayzen).

Another major advantage of the Kayzen groups (the informal name of the quality workshops held in "OPTIX") is the improved feedback. The company management becomes more concerned about the problems of its employees, and the employees become more sensitive to the obstacles they face every day in their organization. Communication between different sections of the enterprise structure is also being improved. And while the quality workshops focus on the problems of their participants' own tasks or sectors, their systematic approach often reveals unexpected ties and causes of problems related to the production cycle. Implementing

the quality workshops requires the same approach as the ISO standards regarding the parameters of the management structure and the internal company trainings. For that reason the quality workshops should be a constant part to the overall quality system of the company.

Commitment of the collective team members to the improvement of every single aspect of the production by applying the quality workshops inevitably leads the customers to building up of trust in the company. Although some companies are not directly binding the workshops with any financial retrieval, most of them can easily determine that the benefits of holding them significantly exceed the corresponding expenses.

### **How to start a quality workshop successfully?**

Companies that hold the most successful quality workshops are those who pay greater attention to their early stages. It is crucial to be sure that each participant is fully informed about the nature of work in the workshops and their purpose.

The steps for successful launching of Kayzen groups are as follows:

- Complete introducing the structure and the essence of the quality workshop to the company management;
- Forming of a „Initiative Committee“ for implementation of the workshops;
- Assigning a project coordinator;
- Defining the main priorities of the workshops;
- Presenting the idea of quality workshops to the first participants;
- Forming the particular workshops and the corresponding participants;
- Assigning a leader to each Kayzen group;
- Formulating a theme;
- Starting the sessions in each workshop;
- All the participants should work systematically and focus on solving the problem implemented in the certain theme, not just discussing it;
- Presenting the workshops' outcomes to the management.

When organizing the workshops one should be aware of the following principles:

- Workshop participation is absolutely voluntary;

- Tuition and self-tuition are constant part of each workshop;
- The workshop functions as a united team;
- Participants solve problems, not just identify them;
- Every single participant is allowed to criticize the ideas of the others, but not their own personalities;
- The only stupid question is the one that has not been asked;
- Accept and stay open to the ideas presented by the rest of the team.

#### **"OPTIX" launched its workshops in 2006.**

At first the management decided that not all the company sections should take part in the pilot project, but to implement this Japanese practice on stages. Due to its importance and existence of quality problems the first workshops were launched in the "Finishing operations" department.

The first workshop meeting was held on 29.06.2006. The main task was to assign a leader for each group and most importantly to set the topic to work on for the next 6 months. The discussions were very lively and led to revealing the most significant problems in each company section. The Kayzen groups named the workshops and the names themselves were quite indicative and interesting: „Ninja“, „Raigrass“, „Flame“, „Arrow“, „Elite“.

When determining the themes, the requirement that all the discussed problems should be solvable, was taken into consideration. Finding solutions should lead to tangible and permanent improvement in the environment, motivation, working conditions, quality and productivity of separate groups. Some of the issues identified were related to the effective use of tooling, reducing the accidents, hygiene on the working place, teamwork and more.

After defining the themes of all the workshops, the members took part in a seminar on the following topic: "Approaches and Techniques for Solving Problems". During this seminar various methods for identification and analysis of problems were shown: "the 7 tools for quality control", "the step-ladder of the quality control", "ways to determine priorities", "5S activities, „3M - Waste and excess" (Muri, Mura, Muda).

Successful results from the pilot quality workshop project convinced the management in "OPTIX" to generally implement this practice and now such workshops are being held in all production sections of the company. On the base of its experience the management concluded that implementing the quality workshops was decisive for employees' awareness raising and motivation increasing, as well as for the company success when using the unlimited potential for generating ideas of each participant. The main advantages of these workshops are encouraging close communication between the personnel of a certain section of the organization, increasing the work satisfaction, building some leadership skills, encouraging creativity among the employees, improving the production process and increasing productivity of the enterprise.

#### **THE „5S" IN "OPTIX"**

The "5S" system was implemented at "OPTIX" in 2003 with a series of activities aiming to improve the working environment set up. Standardization at the working place facilitated the daily activities and imposed a number of improvements that save time.

The 5S activities include:

- Overall arrangement of the tools and removing the unnecessary tools and elements;
- Reducing the waste and improving the labour productivity and quality;
- Keeping a high level of self-discipline, education, communication and overall participation of all the employees in the company activities;
- Developing skills for in-depth analyses of the work done and the standardizing processes;
- Building habits for standardizing of procedures and maintaining the working place well organized through visual control.

While applying the „5S" in "OPTIX" they managed to analyze the results and to define the following outcomes:

- Increased quality;
- Decreased waste of working time;
- Improved safety;
- Decreased expenses for keeping stuff in stock;
- Diminished production cycle;
- Increased employees' morale and improved working environment.



## SAT Ltd. – COMPANY PROFILE AND SCOPE OF ACTIVITY

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### THE BEGINNING

**Systems Automation Technologies – SAT Ltd.** is a private company founded on August 1, 1991. SAT Ltd. is one of the legal successors of the Central Research Institute for Complex Automation of Production (CNIKA), which has been working in this field since 1970. SAT Ltd. combines the intellectual potential and long-standing experience of more than 100 highly qualified specialists. Company's all activities conform to established and operative European standards.

### ACTIVITIES

- Engineering, Development and Marketing of Innovative solutions for complete range of Process Automation and Control Systems;
- Design and Management of Electrical and Automation Projects;
- Application Industrial Software – Programming based on System and Standard Software for Programmable Logic Controllers (PLC) and Operator Stations (OS) of the world leaders: Siemens, Schnieder Electric, Omron, and ext.;
- DCS automation systems – Design and development of Department and Plant Networks (Industrial Ethernet, Profibus DP, Profibus PA, ASI and Modbus networks);
- Equipment for DCS systems - Manufacturing and Supply of the complete range of MCC, DMC, DIO, SCS, Field devices, Instruments, Transmitters and Sensors;
- Low Voltage Distribution (LVD) and Middle Voltage Distribution (MVD) Power Boards (0.4, 0.69 and 6 kV) – Manufacturing, Supply and Installation;
- Electrical Erection, Installation and Connection of cable routes, cables and electrical equipment like Transformers, LVD and MVD boards, Motors, Actuators, and ext.;
- Tests of Electrical Systems – Signal, Rotation, Sequence and Interlocks tests and tuning of the system parameters;
- Training – Operators, Maintenance Staff and Technologists;

- Systems Commissioning – “On Load”, Site Acceptance Tests and Tuning of the systems (Turn-key Projects);

- Guarantee services and uninterrupted technical support.

### SAT IN INDUSTRY

SAT Ltd. offers studies and engineering for specific application, programming and industrial automation, design of all electrical components, installation and commissioning of the entire system and continuous technical support.

SAT Ltd. has completed a number of “Low cost” process automation systems following the latest modern hardware and software attainable decisions in a wide variety of industries. We have gained experience in the Cement, Glass, Concrete, Forages, Power Plants and Metallurgy.

For the last 17 years SAT Ltd. has supplied and successfully commissioned more than 160 “Turn-key” Projects for our Clients not only in Bulgaria, but also in Russia, Serbia, Hungary, Kosovo, Portugal and Nigeria.

SAT has completed automation systems with upgrade of MVD and LVD Systems, new Field Devices and Instruments, new Drives and Actuators, new Soft Starters and Frequency Converters and new Control Systems in the shortest time without interrupting normal production of its departments.

### SAT PROCESS AUTOMATION

Using our thorough knowledge on technological processes, technical parameters of electrical and mechanical equipment, Instruments, Sensors, Transmitters and PLC control equipment, SAT Ltd. developed and commissioned the following Integrated Automation Systems:

- Integrated Automation Systems for Mills Departments (Cement Mills, Raw Mills, Coal Mills);
- Integrated Automation Systems for Rotary Kiln Departments, Clinker Coolers and Clinker Transport;
- Integrated Automation Systems for de-dusting in cement and power plants;





- Integrated Automation Systems for dosing, transporting and mixing for bulk materials in cement and glass plants;
- Integrated Automation Systems for palletizing and shipping in cement and glass plants;
- Technical Information Systems in power, cement and glass plants;
- MV and LV Distributed systems (retrofit or new);
- Motion control;
- Industrial lighting Systems – indoor and outdoor;
- Earthing and Lightning Protection Systems.

#### PRODUCT RANGE

To be straight in the needs of our Clients SAT has developed and now produces and supplies the following main products, using the latest modern hardware and own software decisions for integration in our automation systems:

- Industrial Weight Belt Feeders for bulk materials – full range;
- Industrial Weight Belt Scales for bulk materials – full range;
- Weighbridges (for Trucks and Wagons) – full range;
- Dosing portion equipment for bulk materi-

als and fluids – full range;

- Control Systems for unloading cars (Tripper);
- Control Systems for Stacker / Re-claimer machines;
- Industrial Spillage Conveyors;
- Control Systems for Bag Filters;
- Control Systems for Glass Feeders;
- Control Systems for Port, Bridge and Tower Cranes.

#### INDUSTRIAL HARDWARE OF CONTROL SYSTEMS

SAT Ltd. specializes in development of DCS automation systems based on Programmable



Logic Controllers (PLC) and Operator Stations.

Generally in SAT systems the latest version of SIEMENS PLC SIMATIC S7 is being used, and the list of PLCs is as follows:

- SIMATIC S7-200, S7-300, S7-400 - SIEMENS, DE;
- C200HS - OMRON, JP.

To satisfy our clients' requirements, SAT developed automated decentralized systems with different type of remote boxes placed close to the equipment and connected to the main PLC Process Station by Profibus DP communication.

For these systems SAT elaborated a different type of standard "Distributed Motor Control Centers" (DMC), incl. all necessary commutation equipment (circuit breakers, contactors, relays) and remote PLC input/output modules of the Process Station.

There were also developed standard "Distributed Input/Output" Boxes and "Distributed equipment Control" Boxes (DIO and DEC) to connect all signals from field instruments and equipment.

The Plant Control Systems are normally arranged so as to allow independent control of Each Department. The Separate Process Stations of the departments are connected in a common network by Industrial Ethernet (Process Level of the Control System).

The Operator Station (based on standard PC) must provide the "Human-Machine" communication to the processes. The Plant Control System normally includes two Redundant Servers with a common program for the Project, Engineering Station and a number of Client Operator Stations and printers connected via Industrial Ethernet in a common network (Operator Level). All these equipments are normally placed in Central Control Room (CCR) of the Plant. The Redundant Servers communicate with the Department Process Stations via another Industrial Ethernet network by using Optical cables and accessories.

According to the client requirements centralized automated systems were developed by using a MCC type of control, distributed (DMC concept) or mixing systems (partially DMC, partially a MCC structure) for Plant control.

The practice shows that distributed (DMC) and mixed control systems are more comfort-

able for installation and maintenance and cheaper than MCC type systems.

#### **INDUSTRIAL SOFTWARE**

SAT industrial software is compatible with modern industrial standards, such as SIEMENS WinCC and PCS7, PROFIBUS, MODBUS, HART, ASI, TCP/IP, MS Windows NT/2000 and ext.

The Industrial Automated Systems from SAT are generally based on System Software of SIEMENS: Simatic Step 7 and Protocol for process stations and WinCC V6.1 and PCS 7 for the operator stations and servers.

In a lot of SAT's projects Standard Software Modules "CEMAT V6.x" and "CEMAT V7.x" of Siemens were used. SAT's programmers are familiar with Standard modules of our Clients, such as ITALCEMENT, FLS, KHD, etc.

SAT developed a lot of own Standard Software Modules, certified by one of the biggest cement concern - Holcim.

There are two versions of these modules: "SAT-SM-V05/ST7/WinCC" and "SAT - SM-V07/ST7/ PCS7" for work with PCS 7. The following modules were developed by SAT: Motor, Analog, Group, Path Select, Weigh Feeder, Frequency Converter, LVD & Power Meter modules and Special modules - siren module, HWI module, total module, archive & report modules.

The use of standard Software Modules has the following advantages:

- Standard functions for common tasks;
- Common style of programming;
- Configuring instead of programming;
- Detailed system monitoring;
- Password protected access on several levels;
- Rich visualization system;
- Based on standard system software;
- Object-oriented standard modules useful and easy for tuning;
- Complete Demo Mode support for all standard modules;
- Normal work simulation;
- Start / stop sequences and Interlock simulation;
- Alarm condition simulation.

#### **FUNCTION OF AUTOMATED SYSTEMS BY SAT**

All automated systems developed by SAT based of PLC Process Stations and Operator Sta-

tions are like a perfect instrument addressed to solve the following tasks:

- Standardization of the screens for visualization of the processes on the OS using typical common and detailed templates and animations;
- Monitoring and tuning of all consumers, digital and analog inputs/outputs without programming knowledge;
- Monitoring and tuning of the loops, using OS;
- Archiving: supports large history database, multiple trend displays, user operator settings;

- Archiving of operator and maintenance events;
- Diagnostic of the equipment and self-diagnostic systems with detail alarm messages;
- Data Integrity: protection against incorrect operations or computer malfunctions;
- Multi-user: supports multiple number of OS in redundancy mode, updates a common database;
- Password Protected access levels;
- Ability to expand the systems to upper levels.

## TECHNOLOGICA – A SUCCESSFUL EXAMPLE FOR MANAGING INNOVATIONS

**Ognian Trajanov**, President of TechnoLogica Ltd.

46, Chervena stena Str., 1421 Sofia, Bulgaria

Phone: (+359 2) 91 91 2; Fax: (+359 2) 963 16 10; E-mail: [office@technologica.com](mailto:office@technologica.com)

TechnoLogica is the biggest Bulgarian-owned software company (2007, 2008 CBN - Pannoff, Stoytcheff & Co., ICT Ranks™ Bulgaria 1992 – 2008 [www.cbn-bulgaria.com](http://www.cbn-bulgaria.com)). In 2008 the company takes the 26<sup>th</sup> place in the Technology Fast 50 ranking of Deloitte for the fastest growing technological companies in Central Europe.



TechnoLogica is a technological partner to prestigious companies and organizations, helping them implement and make use of new information technologies in their developments and

projects. The company performs goal-oriented innovative activity by implementing, customizing and further developing new information technologies as well as building technological software tools. The company is acknowledged as an academic model of an innovative company in a number of textbooks and books written by Bulgarian scholars and researchers such as Associate Professor K. Todorov, Professor M. Petrov, etc. In 2008 the software company received special award in the "Innovative Company of the Year 2007" competition.

The company has been a major player on the Bulgarian IT market since 1990. Today it has offices in Sofia, Plovdiv, Varna, Stara Zagora and Skopje (Macedonia).

TechnoLogica has achieved the highest partnership levels with the world's two biggest software companies. The company is an Oracle Certified Advantage Partner and a Microsoft Gold Certified Partner. The company has a Strategic Alliance partnership with PricewaterhouseCoopers Bulgaria. The Quality Management System of TechnoLogica is certified for compliance with the ISO 9001:2000 and AQAP 160 standards.

TechnoLogica has a team of 200 highly qualified professionals. The team has qualified engineers, members with PhD and master's degrees (master's being the most usual degree) in



informatics, computer science and mathematics, as well as specialists in the fields of economics, finance, marketing and production management. Many of them are certified professionals in Oracle, Microsoft, SolidWorks and Cisco. The company employees are provided with a creative environment, stimulating their contribution as professionals and innovators. Free communication is an important characteristic. The Management is not only open to innovative ideas from every possible source but it is also being proactive in the process of conceiving and formulating ideas on the part of the employees.

An average of 15% of the working time of each employee is dedicated to research and development. Most often this time is used for gathering information about new technologies and for analysis of their perspectiveness and applicability. Considering the dynamically changing information technologies nowadays, special attention and resources are necessary for a modernizing and familiarizing education. Evaluating the major role of and need for such education, in 1995 TechnoLogica established the first internationally certified private training center in Bulgaria for professionals in the field of information technologies. The syllabus and materials used for training the IT professionals at the TechnoLogica Education Center (TLEC) are provided by the software leaders who have also certified the lecturers of TechnoLogica. The access to training materials on the new technologies, supporting of certified lecturers and a large number of training courses conducted at the TechnoLogica Education Center offer a possibility for a continuous training of the employees. Special courses for internal trainings on the latest technologies and own technological tools are being developed. These courses have later on been customized for clients as an element of a technological transfer.

TechnoLogica pays special attention to the development of professionals at an international level and by means of sponsoring their certification by leading IT corporations the young people at the company are encouraged to prove their professionalism.

TechnoLogica's software development team is one of the largest and most experienced

teams of IT specialists in Bulgaria. Projects are based on established world standards with the products of Oracle and Microsoft, Case tools, Java, NET, OLAP, WEB, SOA, BPEL, XML. The company's experience in development of nationwide enterprise information systems started in 1994. Between six and eight enterprise information systems are implemented annually.

TechnoLogica's commitment to innovation, its experience with high-tech products and dedication to project success ensure its position as preferred partner for software development. Some of the information systems developed by TechnoLogica are compliant with NATO or EU requirements on Bulgaria and have been subjected to the respective certification. Many projects have been financed by the European Union, the World Bank or the US Government.

Besides the work on specific prestigious projects, the company develops and implements business software, Human Resources Management systems, Enterprise Resource Planning systems (ERP) and Customer Relationship Management system (CRM), Business Processes Modeling systems (BPM), Business Analysis (BI), automation of the engineering labor (CAD/CAM), Project Management (PM), Geographic Information Systems (GIS). The company develops activity in such fields as IT training, System Integration, and Outsourcing Services in the sphere of Human Resources Management.

The developed by TechnoLogica Human Resources Management System, **HerMeS<sup>®</sup>**, was created in 1996 as a commercial product and the very same year the system won a Gold medal at the International Technical Fair in Plovdiv. Ten years later it turned into a de-facto standard and today it is a leader in terms of market share among the corporate clients and foreign investors on the Bulgarian market. For that period of time the system acquired significant international recognition. In 2006 the latest version of the system, **HerMeS<sup>®</sup> V**, was implemented in the Ministry of Defense of the Republic of Macedonia under a project financed by the US Government and currently it is being implemented in the Public Administration of Bosnia and Herzegovina under a project financed by the EU. In 2007 **HerMeS<sup>®</sup>** took the Grand Prix in the category

"A Step into the Future" at the International Fair for Technical and Technological Achievements in Belgrade.

The Human Resources Management System **HeRMes®** is a fully integrated, highly effective tool for automation of all processes and procedures related to this key activity. By supporting management decision making, **HeRMes®** can enhance the adaptability of any organization to the constantly changing competitive business environment. The built-in functions, rules and tools are applicable to organizations of various sizes from all industries.

The latest version of the product, **HeRMes® V**, is an effective instrument for comprehensive representing and planning of the development of the personnel. The system offers a possibility for improvement of skills of the employees by means of conducting trainings and qualification programs. It is a valuable instrument for managing the processes of recruitment and assignment of personnel. The program allows generation of special forms for analysis and integration with other systems such as accounting systems, financial systems, ERP, etc. The processes of personnel payroll calculation are automated.

**HeRMes®** provides an innovative means for the employees to track and update by themselves their personal information in real time. The built-in user tools allow easy generation of reports. The new version V has an entirely new interface which is very user-friendly, intuitive and customizable. In the development of **HeRMes®** TechnoLogica always attempts at being ahead of the market requirements and yet, not losing the contact with the client.

The fifth version of **HeRMes®** is developed using the latest technologies and 38 man/years of programmers' labor amounting at over 2 million EUR are invested in it. Following its practice of providing the latest technologies for the benefit of its clients, the software company offered a series of innovative solutions in the field of engineering design gathered together in a Laboratory for Assistance of Innovative Processes in the Industry.

The laboratory disposes of modern equipment, software and machines, some of which are unique for Bulgaria. The laboratory helps the

companies shorten the innovation process by using external resources. Thus the companies have the opportunity to improve their competitiveness and the quality of the offered products by means of significantly reducing the path from the idea formation to the prototype.

The FDM prototyping machine Vantage X of the company Stratasys is actively used by the companies interested in gaining in a few short hours physical prototypes of their products before they actually go about manufacturing them. The high-end machine works with different materials such as ABS, ABSi и PC-ABS and provides accuracy up to one tenth of millimeter. The laser 3D scanner of the company NextEngine, in combination with specialized software of



SolidWorks, complements the range of instruments for creating complex forms. The DiTra specialists are available to the clients for joint execution of projects in different fields of 3D design, such as modeling and analyses of free forms, products made of sheet metal, welded constructions, machines and mechanisms, tool equipment, pipe and cable systems, photorealistic visualization, animations, etc.

The ambition of the company is for the Laboratory for Assistance of Innovative Processes in the Industry to be acknowledged as a model for such laboratories at technical universities in Bulgaria. Yet in 2007 the University of Rousse "Angel Kunchev" became the first academic institution with a similar laboratory and in 2008, with the financial aid of TechnoLogica, the Machine Building Faculty at Sofia Technical University founded and equipped its CAD/CAM laboratory. Thus the first step to achieving the goal was made, i.e. for the Bulgarian technical universities to become an advocate for the latest technologies and centers for their initial application in industry, as well as for the scientific potential of universities to meet with the needs and projects of industrial organizations. A meeting of the kind would bring numerous benefits to both parties.

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## ALPI CANDY FACTORY – INNOVATIVE COMPANY OF 2007

**Ventseslav Peychev**, Director of ALPI Candy Factory

2, Kozanovsko shose Str., 4230 Assenovgrad, Bulgaria

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ALPI Candy Factory is established in 1995. Since October 2001 the factory operates in its new plant building of 5300 sq. m, equipped with new and upgraded manufacturing facilities.

ALPI Candy Factory is specialized in the manufacture of chewy candies. The factory works with its own unique technologies developed by specialists from the Sugar & Confectioneries Department at University of Food Technologies, Plovdiv. The factory possesses know-how for the production of herbal chewy candies and low-caloric candies, suitable for diabetics. Materials of new generation are used in the production process. Thanks to them, Alpi Herbal Candies are recommended to people suffering from chronic pharyngitis.

Dia Low-caloric Candies are suitable for diabetics and people suffering from overweight. Dia Candies are produced with sugar substitutes and don't cause caries.

One of the most interesting products are candies "Slimbo" (candies for losing weight). They are sugar free and contain the ingredient inulin. That is what makes them suitable for diabetics, too.

ALPI Candy Factory participates in a joint Bulgarian-American project for the purpose of

processing and implanting peanuts in manufacturing. One of the latest factory's products - cereal candies "KRIS-KRIS" is developed on the basis of this project.

Other interesting products are the latest X3 ENERGY (candies with caffeine, guarana and taurin). Two candies are equal to one cup of instant coffee.

And X3 ICE – candies with cooling effect.

The products of the factory have been presented at many international fairs and exhibitions where they were distinguished and received the following awards:

- International Fair Plovdiv, 2007 - Golden Medal;
- International Fair Sial in Paris, 2006 - Certificate for innovation;
- International Fair Plovdiv, 2005 - Golden Medal;
- International Fair Plovdiv, 2002 - Golden Medal;
- International Fair Plovdiv, 1997 - Golden Medal;
- National Exhibition "Made in Bulgaria", 1999 - Silver Lion;
- National Exhibition "Made in Bulgaria", 1997 - Silver Lion;



- Exhibition East-West Euro Intellect, Dubai, United Arab Emirates, 2000 - Golden Medal;
- Exhibition East-West Euro Intellect, Sofia, Bulgaria, 2000 - Golden Medal;
- Exhibition "Best goods and services on Russian market", Moscow, Russia, 2002 — Medal;
- "ARHIMED-2001", Moscow, Russia, 2001 -

Golden Medal;

- America's Grandest Invention Show "INPEX XVIII", Pittsburgh, USA, 2001 - Grand Prix.

65 % of the production of ALPI Candy Factory is meant for export to Russia, Israel, Mongolia, Macedonia, Kosovo, Croatia, Slovakia, Hungary, Romania and USA.





## MADE IN BULGARIA WITH EUROPEAN SUPPORT

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### HI-TECH SOLUTIONS FOR HOTEL MANAGEMENT

**Antoaneta Ilieva**, Product Manager, Eurodesign BG Ltd.

15, Tintiava Str., 1113 Sofia, Bulgaria, *E-mail: ailieva@eudesignbg.com*

**Eurodesign** is a leading provider of IP communications equipment. Based on our development experience and customers demands, we have created a complete, feature-rich and affordable Hotel Management System. **InfoStar** is designed for management and delivery of Video on Demand, VoIP Telephony, IPTV, Internet Access services and many other extras in hotels. The system enables delivery of voice, video, data and information services to each hotel room over the hotel internal IP network. It features intelligent content management, flexible billing and robust content delivery capabilities. InfoStar Triple Play System has an integrated Property Management System (PMS) and can be utilized as a single-box solution for managing the operations of small, medium to big size hotels with thousands of rooms. InfoStar Triple Play System is a module system that enables easy and flexible tailor-made design for any hotel.

demand of the customers for high-quality and performance products. We offer revolutionary devices that will lead the way in the future of communications: Skype to GSM Gateways, VoIP to GSM Gateways, SIP Phones as well as GPS Navigations Systems.

**MobiGater** is a brand that combines the best features of the free Internet calls and the GSM mobility and coverage. The product transfers the incoming Skype/VoIP calls to the user's mobile phone. MobiGater is the right choice for all users who want to have VoIP services on their mobile phones even on the move. Eurodesign BG Ltd.'s SIP phones are the perfect money-saving solution for all home and office users who want to minimize their phone expenses by using the services and prices of the VoIP providers. They support a variety of protocols and can be configured through the web.

One of the latest company's products is the



Eurodesign BG Ltd. developed and manufactured next generation digital products with an emphasis on VoIP solutions and GPS Navigations. The company implements the latest technologies in the consumer electronics and VoIP solution fields in order to satisfy the increasing

3.5" and 4.3" TFT LCD Touch Screen GPS Navigations with SD/MMC slot and build-in Li-Ion battery.

Eurodesign BG Ltd. is based in Bulgaria; headquarters are in Sofia, where the sales, marketing, logistics, administration and R&D departments



are located. The company has also two offices in China (Shenzhen and Huizhou) and a production facility in China as well.

The company is always a part of the biggest consumer electronics exhibitions in the world. The company took part in major annual fairs like CeBIT, Germany; Gitex, Dubai; Orbit-iEx, Switzerland; CERF, Romania; SMAU, Italy and others.

Eurodesign BG Ltd. is aware that the ability to predict and respond immediately to the market demands is decisive in today's competitive environment and its strategy allows it to offer unique and cost-effective electronic solutions that have been long appreciated by company's customers and partners worldwide.

## INFOSTAR – A COMPLETE TRIPLE PLAY HOTEL MANAGEMENT SYSTEM

**Antoaneta Ilieva**, Product manager, Eurodesign BG Ltd.

15, Tintiava Str., 1113 Sofia, Bulgaria, *E-mail: ailieva@eudesignbg.com*

**InfoStar Triple Play System** is a complete interactive solution for hotels that delivers new services to the guests, adds more stylish vision of the guest room, and improves the hotel management. The system is module based and logically divided in several components – Interactive Information module, IPTV module, Access Control module, VoIP Telephony, Climate Control module.

using the remote control in his/her room, the corresponding set-top-box sends a request to our servers. InfoStar authorizes content delivery and bills the guest according to the price list managed by the hotel operator.

InfoStar Triple Play System organizes the entire movie content in different genres, including short movie description and trailer.



**InfoStar** is specially designed for management and billing of Video on Demand (VoD) as well as other triple play services in hotels. When a hotel guest requests a particular VoD content,

### Features of the interactive module:

- o Video on Demand Management and Billing;
- o Video Content Delivery;
- o IPTV Provisioning and Billing;

- o Internet Access and Billing;
- o VoIP Telephony Provisioning and Billing;
- o Music on Demand Management and Billing;
- o Information Channel:

- Welcome message;
- Bill Information;
- Hotel extras information;
- City/Resort information;
- Shopping Information;
- Weather information.

#### **Video Content Delivery**

InfoStar Triple Play System has an integrated video streamer, which distributes video content to each hotel room over the hotel internal IP network. The system supports HD profile and advanced compression like MPEG4, H264 as well as common MPEG2.

#### **Support for Unicast and Multicast Streaming**

InfoStar Triple Play System supports both Unicast and Multicast streaming technologies. Unicast is the traditional method of video delivery over IP networks, where the set-top-box in each hotel room is connected to the Triple Play System via a separate link. That results in higher bandwidth consumption and network utilization, which may present technical challenges in larger hotel properties. In contrast, Multicast streaming allows a single stream to be delivered to each hotel room with very low bandwidth utilization.

**InfoStar IPTV** service is directly delivered to each of the guest TV sets allowing them access to the full range of terrestrial and satellite channels without the need of a separate coaxial network. The system also allows the delivery of live TV content onto large Plasma or LCD screens, with the same picture quality.

**InfoStar IPTV** is a new improved way for watching multimedia products. The TV broadcast is always available, "live" or "on demand", without any risk to miss it. InfoStar provides IPTV, VoD and Hi-Speed data service (i.e. the internet) over the same network directly to the guest in the room.

#### **ACCESS CONTROL AND POWER SAVING SYSTEM MODULE**

InfoStar Access Control and Power Saving module is compatible with a wide range of card reading devices (RFID cards, magnetic stripe

cards, smart cards, etc.). Thanks to our intelligent software, we monitor and control different systems, in order to guarantee power saving and security of the rooms and areas.

#### **Features:**

- o Unauthorized Access Control and Security Alarming;
- o Power Saving by automatically turning off the power in the room;
- o Vacant Room Control Monitoring;
- o Panic Button Maintaining;
- o Safe Box room and outdoor;
- o Unauthorized Access Monitoring and Alarming.

#### **INFOSTAR CLIMATE CONTROL SYSTEM MODULE**

InfoStar Climate Control module controls the climate in each room of the hotel. The system communicates with the reservation system and can maintain a predefined temperature before guest accommodation. The hotel guest can control the temperature from the remote TV control.

Room temperature is controlled by a sensor subsystem. Thanks to it, the system can monitor and alarm for any events such as open doors, windows left open by the guests, etc.

InfoStar Triple Play System is compatible with all Air Conditioning and heating hotel systems.

#### **Features:**

- o Predefined Automatic Temperature Room Control;
- o Intelligent Power Saving;
- o Sensor Subsystem Control and Alarming;
- o Compatibility with all Climate Control Systems.

#### **InfoStar Personnel and Self-Control System modules**

Using these two modules, the hotel management can control and take right decisions for the personnel management, thanks to the accurate information and reference received from InfoStar system.

#### **• Personnel Management System module**

- o Complete Card Payment System within the hotel;
- o Staff Work Monitoring by card access and time;
- o Unauthorized Room Sales Protection;

- o Detailed Central Data Base and Reports;
- o Compatible with most of the hotel Property Management Systems.

• **Self-Control and Diagnostics System module**

- o Monitoring the entire communications between different modules;
- o Monitoring the entire communications in each system module;
- o Detection and localization of the problem.

**InfoStar System is completely compatible with a wide range of PMS software, i.e. Micros Fidelio, Unreal Soft, Clock, Eltur 95, etc!**

**BENEFITS**

InfoStar Triple Play System improves both consumer services and personnel management and accelerates the cost-effective integration of new hotel services - data, voice, video and information services.

All InfoStar modules are based on IP, which leads to drastically low investment for system deployment, compared to common multimedia hotel solutions based on conventional circuit-switched network.

**Hotel benefits:**

1. Revenue increase;
2. Economic benefits of having one network to deliver all services;
3. Easy integration of new services;
4. Personnel management and control.

**Hotel Guests benefits:**

- o Access to the entire movie and music database;
- o Huge range of quality TV programs;
- o Access to the entire hotel services with booking option;
- o Control of all room equipment from the TV remote control.



## EQUAL IN EUROPEAN RESEARCH AREA

### BULGARIAN VIPs

#### IVAN CHOLAKOV

Executive Director of OPTIX Co.



*Awarded with master's degree in Optics and Optical Coating. Executive Director of OPTIX Co. from ten years.*

Mr. Ivan Cholakov is the founder and Executive Manager of OPTIX Co., one of the

leading East European companies in the field of optics. Founded in 1998 as a 100% private organization, OPTIX quickly established a reputation for designing, manufacturing and testing of quality optical components and assemblies, optomechanical and optoelectronic systems for civil and defense applications. Due to its cutting-edge technologies and updated optical and mechanical

design software, the company is able to complete the whole production cycle - from the development stage and prototype manufacturing to serial production of parts, assemblies and devices.

Ivan Cholakov was born in 1954 in the town of Pazardzik. He graduates from LITMO - St. Petersburg in 1980 as a master in optics and optical coating. From 1981 to 1998 works in "Opticoelectron" in Panagurishte, where in 1995 becomes its Executive Director of the Company.

The crucial milestone in his career was his discharge in 1997 due to his resistance to the government decision to put the company in the privatization list and sell it for far beyond the real cost price. In 1998, Ivan Cholakov, together with the leading managers of "Opticoelectron" establishes OPTIX Co. as a private shareholding company. In ten years, the company grew from four employees in 1998 to 360 in 2008.

#### HRISTO YUNGAREV

Managing Director of LB BULGARICUM Plc.



*Manager with big professional experience in the milk-manufacturing branch. Member of the Board of Directors of the National Association of Dairy Processors.*

Dipl. Eng. Hristo Yungarev has been a Managing Director of LB BULGARICUM Plc. since 2004. He

has master's degree in Technology of milk and dairy products from the University of Food Technology in Plovdiv. He has specialized "Business management" in University of National and World Economy, Sofia, and "Marketing and Advertising" in Institute of Economics, Vienna. He has over 28 years of experience in the milk manufacturing branch, as most of his career is connected with "Serdika" Plc. — Sliven, where he worked as department manager, production manager, deputy General Director and General Director. Dipl. Eng. Yungarev also was a Director

of "Balkan Special" Ltd. – Sofia. He is a member of the Board of Directors of the National Association of Dairy Processors.

For a manager with big professional experience it is a real challenge to run the only state milk manufacturing company in Bulgaria, which has become a synonym of connection between science and practice. LB BULGARICUM Plc. possesses a modern Research and Development Center and two modern Production Plants, where along with the traditional Bulgarian dairy products a number of new assortments are produced with the use of new technologies.

The main part of the scientific potential in the Bulgarian milk industry is concentrated in the LB BULGARICUM Plc.'s Research and Development Center. Scientific studies mainly concern industrial production of starter cultures for traditional dairy products and development of functional foods, using the valuable healthy quality of Bulgarian lactic acid strains and application of modern technologies in their production. The LBB collection is the richest in the world regarding the number of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* strains.

Dipl. Eng. Hristo Yungarev successfully leads the process of adaptation of science to the market conditions. The company has developed projects which are approved for funding by the National Innovation Fund of the Ministry of Economy and Energy.

An example for this is the collaboration with "Jossi" Ltd., executing cooperatively a project related to Bulgarian cheese and financed by Bulgarian Small and Medium Enterprises Promotion Agency of the Ministry of Economy and Energy.

R&D Center's team works successfully on projects from the Sixth and the Seventh framework programs of the EU as contacts with the leading R&D Centers in Europe are established.

In years LB BULGARICUM Plc. also works in co-operation with scientific and medical institutes in Bulgaria.

The development and innovative activity during the years gives opportunity for maintenance and extension of licensing potential and position

of LB BULGARICUM Plc. on the international markets.

The Company is proud of more than 40 years of licensing activity. Through the years Bulgarian yoghurt produced using Bulgarian technology and with the starters of LB BULGARICUM Plc. is recognizable by many consumers from different countries.

Today the products of LB BULGARICUM Plc. – white brined cheese, kashkaval (yellow cheese) and starter cultures for dairy products are well-known in Europe, Australia, America and the Near East. The strategy for increasing sales of starter cultures and milk products abroad gives a result – in comparison to 2004 the cheese export has increased eight times and the starters export has increased six times. The agreement signed in 2008 with a French company ensures a market for freeze-dried milk functional product LB Sport in France and Belgium.

Under the leadership of Dipl. Eng. Hristo Yungarev LB BULGARICUM Plc. has also made significant investments in production, and regardless of the crisis it continues working with its projects. The production Plate in Vidin is fully renovated and modernized. Another two projects are almost ready for finalization – one for production of blue and one for production of processed cheese.

LB BULGARICUM Plc. also possesses one of the best-equipped laboratories for milk, dairy products and starter cultures in the country, accredited in 2006 according to ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" by "Bulgarian accreditation service" Executive Agency. The daily control performed by highly qualified specialists guarantees the quality of the company's products.

Under the management of Dipl. Eng. Hristo Yungarev, LB BULGARICUM Plc. implements its mission for retention of production traditions of original Bulgarian dairy products, improvement and development of new technologies and products, for maintenance and enrichment of the unique LBB collection of lactic acid bacteria, bifidobacteria and starters.



## AWARDS

### PETER PETROV IS THE WINNER OF "JOHN ATANASOFF" AWARD

On October 3, 2008 President Georgi Parvanov bestowed "John Atanasoff" award for the year 2008 for achievements in the development of information society to **Peter Petrov** from Veliko Tarnovo, assistant professor and lecturer at University of Maryland in College Park. The award for the sixth time is given to a young Bulgarian having significant contribution to the development of computer and information technologies and information society in Bulgaria.



**Tsenyu Galchev**, Bachelor degree student at University of Michigan in electrical engineering, electronics and information technologies got **special diploma** from the President of the Republic of Bulgaria for contribution to the development of information society in the country. Bulgarian researcher has essential contribution to creation of a low-frequency energy generator fed by vibrations of the environment.

For the first time this year the President han-

ded a diploma "**John Atanasoff – for school-children**" for achievements in the field of informatics and information technologies. Such a diploma was handed to **Rumen Hristov** from High School of Natural Sciences and Mathematics in the city of Shumen and **Alexander Koralski** from High School of Natural Sciences and Mathematics in the city of Montana. Both of them are gold medal winners from international Olympiads in information technologies and informatics.

The next step will be establishment of "John Atanasoff" award for students.

The award after the name of the famous scientist of Bulgarian origin and creator of the first computer in the word John Atanasoff was established by President Georgi Parvanov in 2003. President's idea is to turn the award into a form of stimulation of the growing ups and young scientists' research and technological creative work as a basis for development of information and knowledge-based society.

### BAIT AWARD FOR 2008 "FOR OUTSTANDING MERITS IN THE DEVELOPMENT OF INFORMATION TECHNOLOGIES IN BULGARIA"



In November during the thirteenth national exhibition on information and communication technologies **BAIT EXPO 2008** the annual award of the Bulgarian Association for Information Technologies (BAIT) for entire activity and considerable contri-

bution to the development of information and communication technologies in Bulgaria was bestowed.

This year the award was adjudged to academician **Peter Kenderov** for his exceptional contribution to the development of mathematics and informatics in Bulgaria and strengthening our country's research authority abroad, as well as for creation of a world-recognized school in teaching mathematics and informatics,

for his personal merits in building of generations of young mathematicians and information specialists many times distinguished at world and national Olympiads, and other activities.

In 1966 acad. Peter Kenderov graduates from the faculty of Mechanics Mathematics at Moscow State University, where he defends his PhD dissertation. In 1970 he starts his work as a research associate for the Institute of Mathematics at Bulgarian Academy of Sciences. In 1982 he defends his doctoral thesis, and from 1983 to 2003 he is a professor in the same institute.

In 1985 he is elected corresponding member of BAS, and since 1995 he is a full member of the Academy.

He is Doctor Honoris Causa of universities in Plovdiv and Baia Mare, Romania.

He has been a guest lecturer in a number of foreign universities: Canberra and Newcastle, Australia; Murzia, Spain; Milan and Genoa, Italy; Oakland, New Zealand; Bairoit, Germany; Limoge, France. He has been a member of editorial boards of a number of scientific journals.

For his research and lecturer's activities he was honoured with foreign and national awards.

Acad. Kenderov took part in organization of many scientific events and forums.

In 2000 he was elected senior vice-president of the World Federation of National Mathematics Competitions (WFNMC) with headquarters in Canberra, Australia. In 2002 he was elected a

member of the Executive Committee of the International Commission on Mathematical Instruction by the General Assembly of the International Mathematical Union.

With his energetic public activity acad. Kenderov has a considerable contribution to creation of Bulgarian school of mathematics and informatics, for strengthening of different forms helping to discover and promote development of talented young people. He has contributed to creation and strengthening of national with international character Olympiads on mathematics and informatics as a permanent school for development of young talents. In 1989 he was a Chairman of the Organizational and Selection Committees of the First International Olympiad on Informatics for secondary school students. On his initiative in 1995 an award is established and is annually delivered to teachers with greatest contribution to discovering and development of talented schoolchildren in Bulgaria in mathematics, informatics, physics, chemistry, and biology. He is among the initiators of the founded in the year 2000 Students Institute of Mathematics and Informatics.

Acad. Kenderov is President of the International Foundation *St Cyril and St Methodius*, based in Sofia, Bulgaria since 1998.

He is the author of four textbooks and has more than 85 research articles published in specialized mathematical journals.

## ARTICLES

### RECENT PUBLICATIONS OF BULGARIAN SCIENTISTS

- Title:** **A new approach for the combined chemical and mineral classification of the inorganic matter in coal. 2. Potential applications of the classification systems.**
- Authors:** Vassilev, Stanislav V.<sup>1,2</sup> vassilev\_stan@yahoo.com, Vassileva, Christina G.<sup>1</sup>, Baxter, David<sup>2</sup>, Andersen, Lars K.<sup>2</sup>
- Source:** Fuel, Vol. 88, 2, (Feb. 2009), 246-254.
- Author Affiliations:** <sup>1</sup>Central Laboratory of Mineralogy and Crystallography, Bulgarian Academy of Sciences, Acad. G. Bonchev Street, Block 107, Sofia 1113, Bulgaria;  
<sup>2</sup>Institute for Energy, Joint Research Centre, European Commission, P.O. Box 2, NL-1755 ZG Petten, The Netherlands.
- ISSN:** 0016-2361
- 
- Title:** **Design and synthesis of a novel pH sensitive core and peripherally 1,8-naphthalimide-labeled PAMAM dendron as light harvesting antenna.**
- Authors:** Georgiev, Nikolai I.<sup>1</sup>, Bojinov, Vladimir B.<sup>1</sup> vlbojin@uctm.edu, Nikolov, Peter S.<sup>2</sup>
- Source:** Dyes & Pigments, Vol. 81, 1, (Apr. 2009), 18-26.
- Author Affiliations:** <sup>1</sup>Department of Organic Synthesis, University of Chemical Technology and Metallurgy, 8, Kliment Ohridsky Blvd., 1756 Sofia, Bulgaria;  
<sup>2</sup>Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria.
- ISSN:** 0143-7208
- 
- Title:** **The potential of the gyrotrons for development of the sub-terahertz and the terahertz frequency range — A review of novel and prospective applications.**
- Authors:** Idehara, T.<sup>1</sup>, Saito, T.<sup>1</sup>, Ogawa, I.<sup>1</sup>, Mitsudo, S.<sup>1</sup>, Tatematsu, Y.<sup>1</sup>, Sabchevski, S.<sup>1,2</sup> sabch@ie.bas.bg
- Source:** Thin Solid Films, Vol. 517, 4, (Dec. 2008), 1503-1506.
- Author Affiliations:** <sup>1</sup>Research Center for Development of Far Infrared Region, University of Fukui, 3-9-1 Bunkyo, 910-8507 Fukui, Japan;  
<sup>2</sup>Institute of Electronics of the Bulgarian Academy of Sciences, 72, Tzarigradsko Shose Blvd., 1784 Sofia, Bulgaria.
- ISSN:** 0040-6090
- 
- Title:** **Novel blue emitting tetra- and pentamethylpiperidin-4-yloxy-1,8-naphthalimides as photoinduced electron transfer based sensors for transition metal ions and protons.**
- Authors:** Bojinov, Vladimir B. vlbojin@uctm.edu, Panova, Ionka P.
- Source:** Sensors & Actuators B: Chemical, Vol. 135, 1, (Dec. 2008), 172-180.
- Author Affiliations:** University of Chemical Technology and Metallurgy, Department of Organic Synthesis, 8, Kliment Ohridsky Blvd., 1756 Sofia, Bulgaria.
- ISSN:** 0925-4005



- .....
- Title:** **Metal recovery from a copper mine effluent by a hybrid process.**  
**Authors:** Nenov, V.<sup>1</sup>, Lazaridis, N.K.<sup>2</sup>, Blücher, C.<sup>2</sup>, Bonev, B.<sup>1</sup>, Matis, K.A.<sup>2</sup>  
kamatis@chem.auth.gr  
**Source:** Chemical Engineering & Processing, Vol. 47, 4, (Apr. 2008), 596-602.  
**Author Affiliations:** <sup>1</sup>Burgas "Asen Zlatarov" University, Department of Water Treatment, Burgas, Bulgaria;  
<sup>2</sup>Division of Chemical Technology, Chemistry Department, Aristotle University, Box 116, Thessaloniki, Greece.  
**ISSN:** 0255-2701
- .....
- Title:** **A new generation of cyanide ion-selective membranes for flow injection application: Part III. A simple approach to the determination of toxic metal-cyanide complexes without preliminary separation.**  
**Authors:** Surleva, Andriana R.<sup>1</sup>, Neshkova, Milka T.<sup>2</sup> mnesh@mbox.contact.bg  
**Source:** Talanta, Vol. 76, 4, (Aug. 2008), 914-921.  
**Author Affiliations:** <sup>1</sup>University of Chemical Technology and Metallurgy, Department of Analytical Chemistry, 8, Kl. Ohridsky Blvd., 1756 Sofia, Bulgaria;  
<sup>2</sup>Laboratory of Electrochemical Sensors, Institute of General & Inorganic Chemistry, Bulgarian Academy of Sciences, Acad. G. Bonchev Str., Block 11, 1113 Sofia, Bulgaria.  
**ISSN:** 0039-9140
- .....
- Title:** **Synthesis and Characterization of Novel (9H-Fluoren-9-ylamino) Carbonylaminomethylphosphonic Acid.**  
**Authors:** Todorov, Petar<sup>1</sup>, Naydenova, Emilia<sup>1</sup>, Popova, Julita<sup>1</sup>, Troev, Kolio<sup>2</sup>  
**Source:** Heteroatom Chemistry, Vol. 19, 7, (2008), 719-722.  
**Author Affiliations:** <sup>1</sup>University of Chemical Technology & Metallurgy, Organic Chemistry Dept., BU-1756 Sofia, Bulgaria;  
<sup>2</sup>Bulgarian Academy of Sciences, Institute of Polymers, BU-1113 Sofia, Bulgaria.  
**ISSN:** 1042-7163
- .....
- Title:** **Novel organic material with potential NLO application – electronic and spectroscopic properties.**  
**Authors:** Koleva, B. B.<sup>1</sup>, Kolev, T.<sup>2</sup>, Nikolova, R.<sup>3</sup>, Zagariarsky, Y.<sup>3</sup>, Spitteller, M.<sup>2</sup>  
**Source:** Central European Journal of Chemistry, Vol. 6, 4, (Dec. 2008), 592-599.  
**Author Affiliations:** <sup>1</sup>Ruhr University Bochum, Lehrstuhl Analyt. Chem., D-44780 Bochum, Germany;  
<sup>2</sup>University Dortmund, Inst. Umweltforsch., D-44221 Dortmund, Germany;  
<sup>3</sup>Sofia University St. Kliment Ohridsky, Organic Chemistry Dept., Sofia 1164, Bulgaria.  
**ISSN:** 1895-1066
- .....
- Title:** **Novel biodegradable adaptive hydrogels: Controlled synthesis and full characterization of the amphiphilic co-networks.**  
**Authors:** Mespouille, Laetitia<sup>1</sup>, Coulembier, Olivier<sup>1</sup>, Paneva, Dilyana<sup>2</sup>, Degee, Philippe<sup>1</sup>, Rashkov, Iliya<sup>2</sup>, Dubois, Philippe<sup>1</sup>  
**Source:** Chemistry - A European Journal, Vol. 14, 21, (2008), 6369-6378.  
**Author Affiliations:** <sup>1</sup>University Mons Hainaut 20, Lab. Polymer & Composite Mat., CIRMAP, B-7000 Mons, Belgium;

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Sofia 1113, Bulgaria

ISSN: 0947-6539

**Title:** **Accounting for secondary extinction in a novel x-ray absorption method used for thickness measurements of thin foils.**

**Authors:** Tomov, I.<sup>1</sup>, Vassilev, S.<sup>2</sup>, Tzvetkov, P.<sup>3</sup>

**Source:** Archives of Metallurgy and Materials, Vol. 53, 1, (2008), 265-270.

**Author Affiliations:** <sup>1</sup>Bulgarian Academy of Sciences, Jordan Malinowski Central Laboratory of  
Photograph. Proc., Sofia 1113, Bulgaria;

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## E V E N T S

### BAIT EXPO 2008 – NATIONAL ICT FORUM

In November 2008 a **National forum dedicated to the status and development of information and communication technologies in Bulgaria** was held within the framework of the biggest specialized national exhibition on information and communication technologies **BAIT EXPO 2008**.

The aim of the forum was to present the state and trends connected with the policy and regulation in the field of information and communication technologies in Bulgaria, to discuss ideas, suggestions and challenges before the ICT industry in Bulgaria connected with sustainable development of this sector. One of the main reports at the forum – **“Bulgarian ICT Market 2008 – Challenges and Opportunities”** delivered by the President of the Managing Council of BAIT Mr. Boyan Boychev analyses the state and development of the market of information and communication technologies in the country, possibilities for development of public-private partnership and other problems topical for the

development of the Bulgarian ICT industry.

State Agency of Information Technologies and Communications (SAITC), Bulgarian Association of Information Technologies (BAIT), Commission for Regulation of Communications (CRC), Association of Telecommunications (ASTEL), Association of Bulgarian Cable Operators (ABCO), Association of Bulgarian Radio and Television Operators (ABRO) and “Bulgarrekлама” Agency are organizers of this large-scale and representative forum, which is held for the second consecutive year.

The forum on the development of information technologies is traditionally held during the biggest ICT Exhibition in our country – BAIT EXPO 2008 with participation of over 130 companies – exhibitors, with a series of specialized seminars. On the joint stall “Educational Forum” the most recent solutions and products for the use of information and communication technologies for educational purposes were demonstrated.

### MICROSOFT BULGARIA WITH FIRST CONFERENCE ON INTEGRATED SOLUTIONS FOR BUSINESS MANAGEMENT

Microsoft Bulgaria for the first time organizes a conference dedicated to **integrated solutions for business management**. Leading experts from the company, KPMG and Deloit Bulgaria presented opportunities for optimization of expenses and increasing competitive power of Bulgarian companies by means of business applications.

Business solutions of Microsoft integrated into the product line **Microsoft Dynamics** were the main topic of the conference. They give Bulgarian companies an access to the best world practice in conformity with specific features of

different sectors of the economy. The solutions of Microsoft Dynamics guarantee a gradual process of implementation owing to the well-known interface and easy integration with the existing systems used by the companies. At the same time they are in compliance with particular obligations and specific character of separate employee’s work. It leads to an increase of employees’ labour productivity and solutions efficiency on managerial level.

Microsoft’s experience based on a long-term collaboration with over 10 000 partners of the company from all over the world, who developed

more than 1 800 solutions building up the basic platform of the programs, was presented within the framework of the conference. The accent was made on the local solutions developed by the 20 partners of the company in Bulgaria. Different prospects connected with implementation of business solutions of ERP and CRM type, which guarantee effective management of business processes and help companies become more productive and competitive, were presented

at the forum.

By the number of clients and partners in Bulgaria Microsoft is the leader in the field of high-class business applications. It has at its disposal specialized solutions in keeping with specific character of all kinds of industries, which are entirely in conformity with the specifics of the Bulgarian market both functionally and as a pricing. Its products are suitable for small, medium and large companies.

## FIFTH NATIONAL COMPETITION FOR INNOVATIVE ENTERPRISE OF THE YEAR 2008

In February 2009 for the fifth year a **National Competition for innovative enterprise of the year 2008** will be held, organized by "Applied Research and Communications" Fund, Enterprise Europe Network – Bulgaria, in partnership with the Ministry of Economy and Energy, the World Bank Mission in Bulgaria, and with the support of the Executive Agency for Promotion of Small and Medium-sized Enterprises.

The European Commission declared **2009 for Year of Creativity and Innovation**.

Could Bulgarian economy meet this challenge?

The competition is dedicated to innovative Bulgarian companies, which in spite of difficulties do their best not only to survive, but to create innovations, to look into the future and to compete on the European level.

Its purpose is to show a good Bulgarian model for business, to draw attention of a general public to achievements of Bulgarian enter-

prises in the field of innovations and in this way to stimulate more companies for success.

Innovative enterprises from all sectors of Bulgarian industry including information technologies can take part in the competition.

The candidates will be judged by an expert commission according to special methodology. The top ten companies with highest results will be visited by experts from ARC Fund. At the final stage the nominations will be considered by a selection committee formed by representatives of ministries, employers', research and non-profit organizations, the World Bank Mission, etc.

The "Innovative Enterprise of the Year" award was declared to be one of the best experiences of the European IRC Network, which is due to the positive results of the initiative – promotion of innovative activity of Bulgarian enterprises and popularization of their results in the field of innovation.