NOVACAST

FOUNDRY TECHNOLOGY

CONSULTING & EQUIPMENT
INDUSTRIAL COMPUTER SOFTWARE
EXPERT SYSTEMS

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Num Lock	SuperExpert QUERY	file: CASTDEF problem: start	time: 16:44:54 bytes: 152137	Caps Lock

CASTING DEFECT ANALYSER

An Expert System for analysing defects in Castings
Version: 87-I Grey- & Ductile Iron

R & D and Knowledge Engineering : R.V. Sillén
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Soft Center, S-Ronneby, Sweden

Type any key to continue...

Num Lock	SuperExpert QUERY	file: CASTDEF problem: start	time: 16:45:39 bytes: 152137	Caps Lock

Examine the defective casting visually.
How would you describe or classify the defect?

1) The defect looks like a shrinkage inside the casting

2) The defect looks like an outer surface depression or shrinkage

3) It seems to be a gasblow or porosity caused by gases.

4) The matrix or the graphite shape in unnormal

5) I am not sure how to classify the defect and want some advice.

enter number(1..5):
>

Num Lock	SuperExpert QUERY	file: CASTDEF problem: selector	time: 16:47:34 bytes: 152137	Caps Lock

Your answer to the question about view_insid was big_hole

The most likely classification of the defect is that it is:

A shrinkage cavity formed during the later part of the solidification and thus localized in the center portion of the casting.
We will now try to define what caused the defect ...
Press RETURN to load the next module ..

Type E for explanation or type any key to continue...

Num Lock	SuperExpert QUERY	file: CASTDEF problem: inside_shr	time: 16:48:47 bytes: 152137	Caps Lock

Your answer to the question about feeder_typ was normal

How would you describe the pipe in the feeder?

1) the pipe is very deep and narrow

2) the pipe looks normal

3) the pipe is wide and shallow

4) the pipe is very small or nonexistent

enter number(1..4):
>

Num Lock	SuperExpert QUERY	file: CASTDEF problem: proces_shr	time: 16:50:35 bytes: 152137	Caps Lock

Your answer to the question about analysis was yes

Which alloy has been used?

1) nodular cast iron

2) grey cast iron with a carbon equivalent of > 3.8%

3) other

enter number(1..3):
>

Num Lock	SuperExpert QUERY	file: CASTDEF problem: graphitdef	time: 16:52:18 bytes: 152137	Caps Lock

Which shape has the graphite?

1) Quite normal spheres - maybee with some minor irregularities

2) The graphite spheres seems to have "exploded"

3) A large portion of the graphite is "wormlike"

4) The graphite is of type flake with thin sharp protrusions.

5) chunky

enter number(1..5):
>

Num Lock	SuperExpert QUERY	file: CASTDEF problem: start	time: 16:58:20 bytes: 152137	Caps Lock

Here is my conclusion and advice :

The graphite has formed bigger nests than normal. During machining some of these nests have been pulled out of the surface leaving small holes. Basically the number of start nuclei have been to few and the amount of graphite has been too high.

REMEDY: Reduce carbon so that the Ceqv suits the section area.
Phosphorous should not exceed 0.12 if in grey iron.
Check amount of inounculant used. Reduce if possible.
Check melting practice - add carburizers late and avoid superheating too much as that will destroy nuclei.
Check pouring temperature. Reduce if possible.

Consultation ended.

Type E for explanation or type any key to continue...

Num Lock	SuperExpert QUERY	file: CASTDEF problem: start	time: 16:59:07 bytes: 152137	Caps Lock

Check pouring temperature. Reduce if possible.

Consultation ended.

The value of start is selector since
the value of defect is dont_know.

The value of selector is matrixdef since
the value of view_outsi is other and
the value of view_insid is matrixdef.

The value of matrix is open_grain since
the value of defect_typ is open_grain and
the value of iron_type is grey and
the value of cast_locat is under_surf and
the value of section is normal.

Type E for explanation or type any key to continue...

Part of the Sandmaster Manual

Sometimes it might help to save the COMMAND.COM file once more from the DOS to the NOVACAST disk.
If you still should have a problem then something might have happened to the diskette or the disk drive - Call our distributor and we will send you a new copy.

Theory of Operation - SANDMASTER.

A green sand system is a very complex unstable system. It involves numerous variables who are subjected to frequent changes. Some of the more obvious variables are :

Type of base sand, grain shape, grain size, grain size distribution, type of clay, amount of active clay, clay addition, amount of fines, type of sea coal, amount of sea coal, sea coal properties, amount of lustrous carbon, water content, mixing time, humidity, sand temperature, amount of metal poured, amount of core sand, amount of new sant, cooling time etc .....

Normally a foundry uses a standard recipe for additions to be made e.g. 0.4 % bentonite, 0.5% sea coal dust, 2 % new sand. These additions are made in the muller regardless of what is beeing poured at the moment!
A sample of the sand is usually taken a couple of times each shift or in some cases once an hour. Physical properties are tested - compression strength, shatter index, moisture, gas permeability, compactability. Other tested parameters might involve methyl blue, sieve analysis, wet tensile etc.
Based on these test results corrections in the additions are made.
The result is that the properties shows "sinus"-curve variations if plotted on a paper with the time as X-axis.
Why?
The reason is that the test results are not correlated to the present situation! The regulating method has a too long delay period - the foundry is in fact regulating "after the fact". That method will only work if the variations in the main variables are nil - that is if the sand/metal ration would always be the same etc. That is very seldom the case and thus the variations.

Here is an example : let us assume that we are pouring a pattern giving a sand/metal ration of 9:1 with no cores. The additions of bentonite are 0.4 % and the properties are stable. Then we change pattern so that the sand/metal ratio is 5:1 and the core sand adds about the same as 3% new sand. No notice is given to the sand plant. The result is that the moulding sand will be "burnt-out" to a much higher degree. The core sand will act as new sand and as its bentonite content is 0 it will require may be 7% addition to reach the average level. The result is that the sand properties are drastically reduced. After maybee an hour this is noticed in the sand plant.

They then increase the additions of bentonite and maybee also carbon. Then after some time the physical properties starts to climb upwards to normal levels. The additions af bentonite might at this point be say 0.7%. Then another pattern change is made this time to a pattern that gives a sand/metal ratio of 11:1 and with no cores. What happens? The sand is burnt out to a much lesser degree of course, but the additions remain the same and consequently the compression strength etc increases very rapidly. When noticed in the sand plant after 1 or 2 hour it is too late the properties are already above the upper limit - additions are lowered and so on.
Thus in some cases the sand contains too much active clay and in some cases too little. This is of course harmful and as ideal properties can not be kept it will give rise to casting defects - such as scabs, rattail, erosion, penetration, burnt on etc.
Also the consumption of additives will be higher that needed.
The sand is "dead-burned" when the temperature reaches approx 650 C. For a given casting section that temperature is reached at a certain distance from the surface - thus if the active clay in that sand layer is 8% instead of the ideal 6% the bentonite consumption has increased 33% !

The idea behind SANDMASTER is to make "intelligent" predictions of the consequences when a pattern is changed and that the additions should be changed so that the ideal properties are maintained. This technique where the additions are related to a specific pattern will minimize the variations in the return sand.

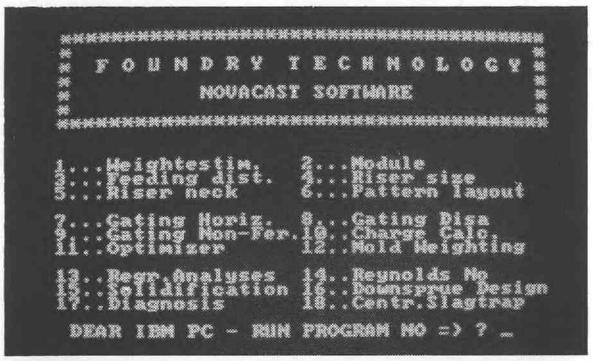
As there are a large number of parameters involved it is not possible to write a mathematical formula that considers all variations - it will only be valid for a short period.
Therefore the technique used in SANDMASTER is an Artificial Intelligence approach. You tell the system what properties you as an expert think are good for your moulding system. Then you teach the program by entering laboratory values daily. The program uses a rolling database and induces new algorithms as soon as it feels that something has changed.
Thus SANDMASTER is an "Expert-System" that adopts itself to new conditions all the time.

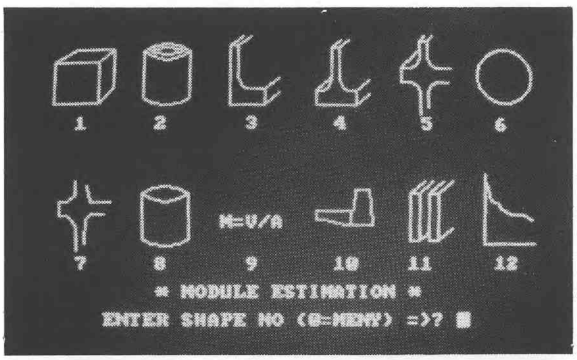
HOW TO USE THE "SANDMASTER"

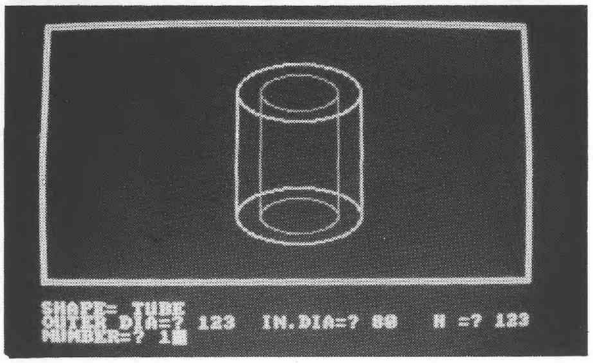
The "SANDMASTER" programs will make it possible to control and modify a green sand system to achieve stable properties and to minimize additives. Stable physical properties at the correct levels are extremely important parameters in order to make castings with close tolerances and at a low scrap rate. A green sand system is a very complex system with a lot of variables having an influence on the properties. This software will make it possible to master these conditions thanks to the computers ability to store, calculate, make choices and to optimize.
The requirements on a green sand system vary depending on type of alloy, mould size etc.. The program is therefore based on experiences from your present sandsystem.

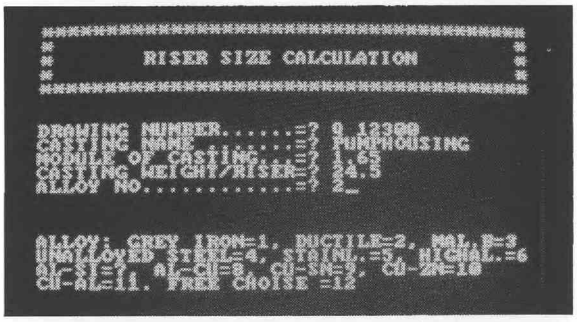
INDUSTRIAL COMPUTER SOFTWARE

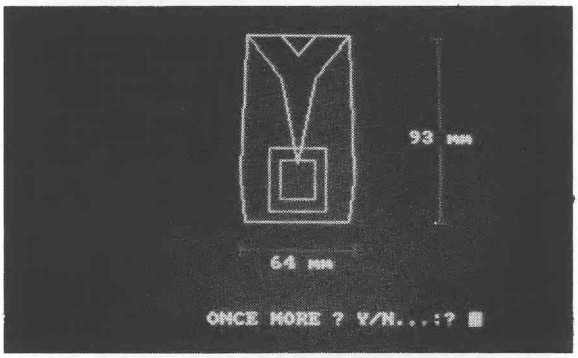
Novacast supplies industrial computer software which will enable any foundry to get on top of its problems easily, economically and permanently. Whether the area concerned is FOUNDRY TECHNOLOGY and CASTING METHODS DESIGN, PROCESS CONTROL, PRODUCTION CONTROL or even a specialized "EXPERT-SYSTEM", Novacast has a system to suit. Since the introduction in 1980 more than a hundred foundries in many countries benefit from computer programs provided by Novacast. More than 2000 factors affect the success or failure of casting processes. Controlling and predicting their influence is a highly complex area. The Novacast programs SANDMASTER, METALMASTERS are therefore build as "Expert-system" using "Artificial Intelligens" methods enabling automatic program adjustment depending on external conditions. The programs will run on IBM PC, APPLE II and compatible computers.
The programs allow you to use an scientific, consistant approach thus improving yield, reducing scrap and number of test pours as well as costs for input materials.

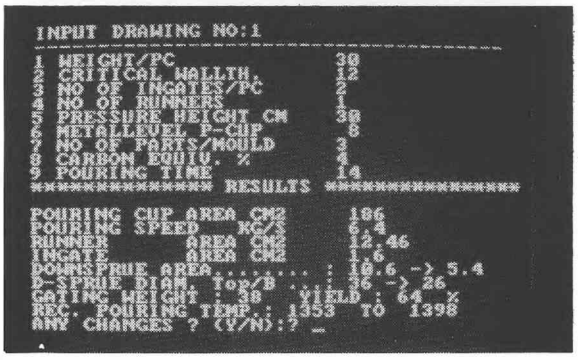












WEIGHT ESTIMATION is easily made from a drawing or a sample. Graphics presentations are used to a large extent.

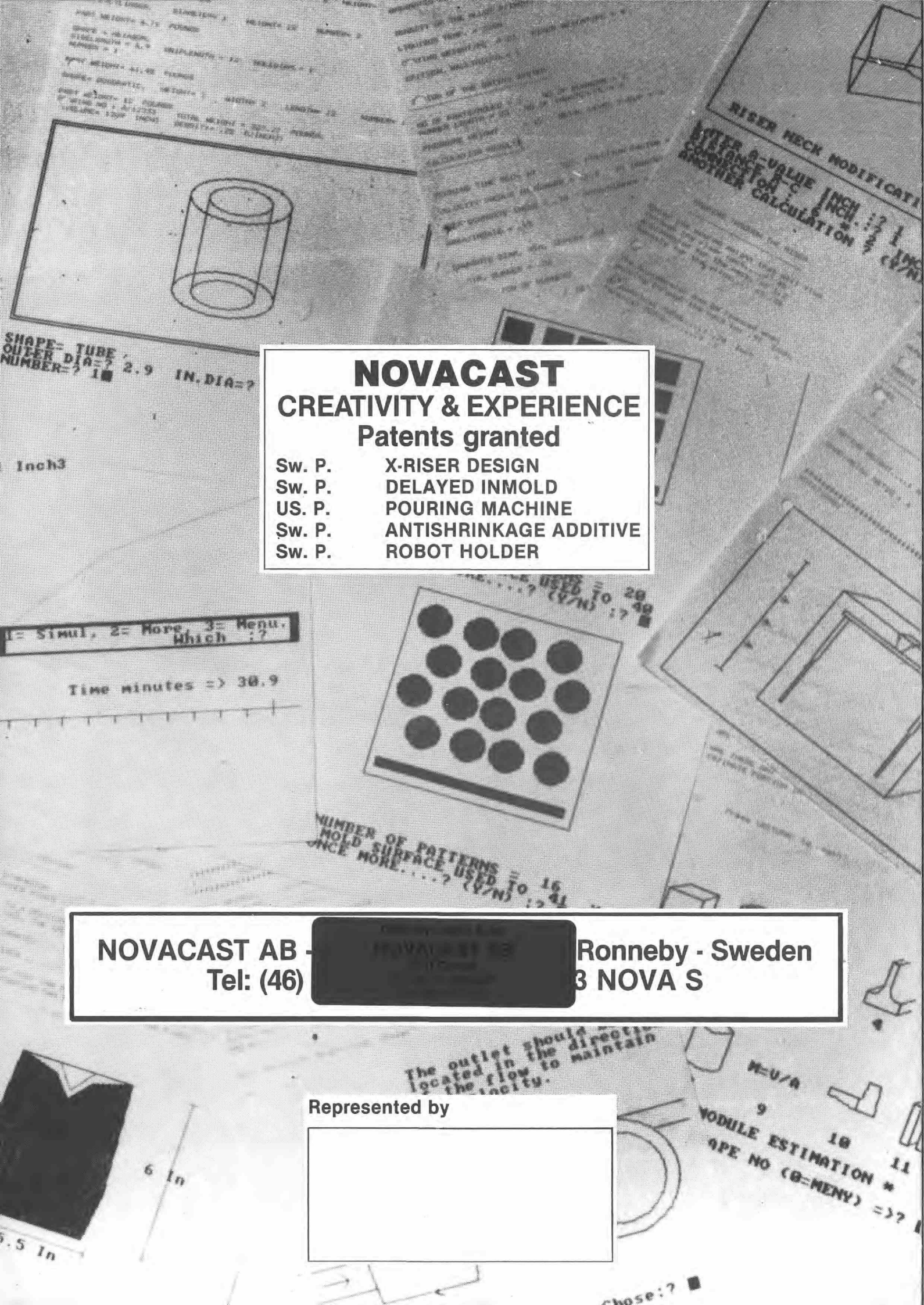
MODULE CALCULATION is the base for the riser size calculation. The **RISER SIZE** program gives the optimal dimensions weight, feed distance etc.

A PATTERN LAYOUT can drawn on the screen showing number of patterns and mould utilization.

Three different types of **GATING PROGRAMS** area available : for horizontal- and vertical moulds and for non-ferrous.

Other programs are : **CHARGE, OPTIMIZER REYNOLDS NO, SOLIDIFICATION SIMULATION DOWNSPRUE DESIGN, CENTRIFUGAL SLAG TRAP, RISER NECK, FEEDING DISTANCE MULTIPLE REGR. ANALYSIS, MOULD WEIGHTING, RUNNER DESIGN, SANDMASTER, METALMASTER.**
PRESSURE DIE CASTING—NOVASHOT.

We cooperate with several software companies in Europe and in the US and are thus in a position to supply you with other types of industrial software programs. Computerized systems for **MAINTENANCE,** and **PRODUCTION PLANNING** from **DEWTEC** are some examples.
We can also "tailor"-make programs for special purposes.
Our partner concerning "Expert Systems" is **INTELLIGENT TERMINALS Ltd.**



NOVACAST

CREATIVITY & EXPERIENCE

Patents granted

Sw. P.	X-RISER DESIGN
Sw. P.	DELAYED INMOLD
US. P.	POURING MACHINE
Sw. P.	ANTISHRINKAGE ADDITIVE
Sw. P.	ROBOT HOLDER

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