



**COGNITIVE  
PILOT**

**AUTOPILOT  
FOR AGRICULTURAL  
EQUIPMENT BASED ON  
ARTIFICIAL INTELLIGENCE**

*Expanding the limits of  
harvesting*

**2021**



**Cognitive Agro Pilot**  
standard option for "Gomselmash" and  
"Bryanskselmash" combines

# ROBOT ASSISTANTS ARE CHANGING OUR WORLD

A unique feature of our times is the rapid emergence in people's everyday lives of items based on the most advanced innovations in science. What we saw in sci-fi films 10-15 years ago are now commonplace objects for our lives or work. In the wake of these changes, robots – the smart devices that help people do hard and boring work – are coming into our lives.

**At Cognitive Pilot, we have created a truly intelligent robot-assistant for agriculture**

Our product makes the future available today, because it's based on the most advanced AI technology



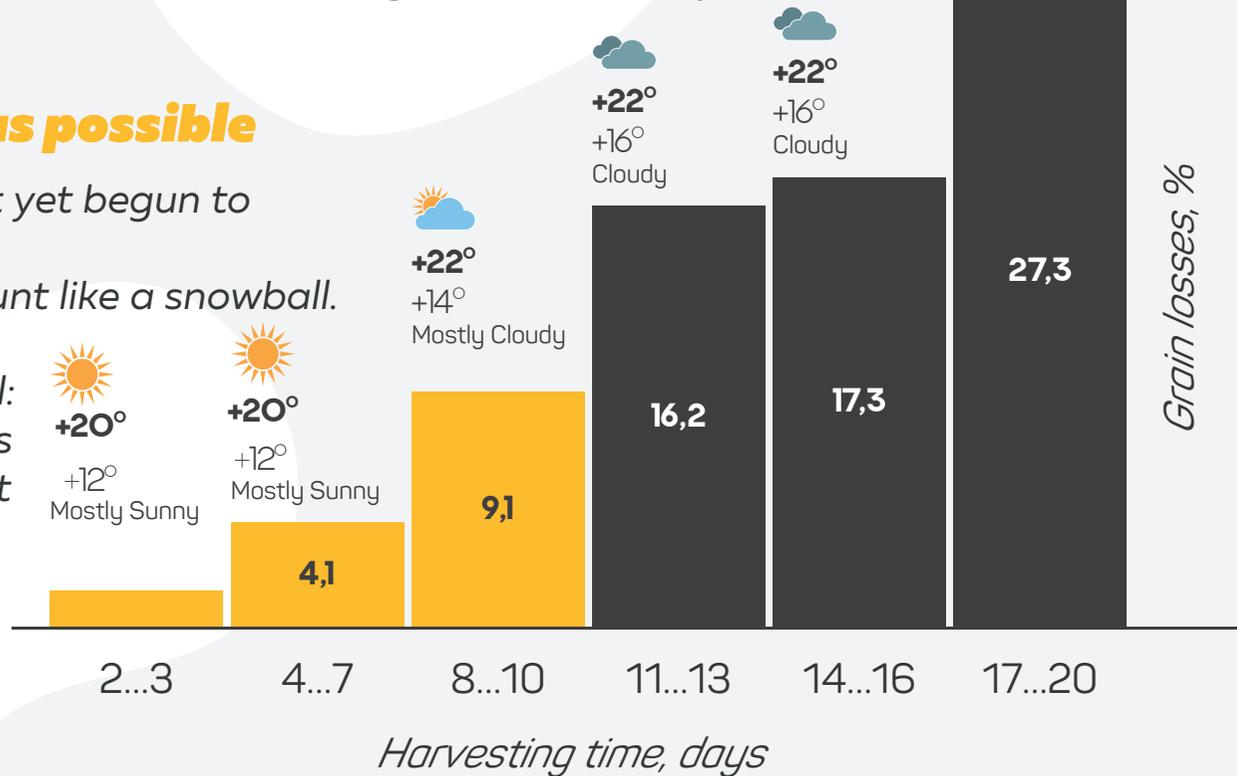
# HARVEST IS THE TOTAL SUM OF THE WHOLE SEASON'S WORK

## Crop farming is a challenging and risky business

Throughout the agricultural season, farmer invests a lot of efforts and resources in tillage, sowing and applying crop protection products. In addition, he takes on the risks associated with weather, pests, market demand and changing legislation. It is only after a successful harvest that he gets the long-awaited result. But doing so is not an easy task.

## The general rule is to reap the harvest as quickly as possible

The time when the crop is ripe and has not yet begun to crumble is a matter of days. From there, the irrecoverable losses start to mount like a snowball. An extra week of harvesting takes about 3-5 % of the grain. But that's not all: weather conditions also make adjustments to the harvesting schedule, so it's a real art to fit in the weather window and lose as less of crop as possible.



## WHAT'S STOPPING YOU FROM HARVESTING FASTER?

Obviously, to harvest quickly, each combine harvester needs to harvest as much as possible on the days when the weather allows to. However, combine harvesters are in short supply because they cost a lot of money.

**But there is another solution to this problem – raise the productivity of the existing fleet**

What is holding back the productivity? The workload of the operator during harvesting is very high. In addition to his main task (controlling the harvesting units), he has to drive the combine, maintain speed, slow it down before the areas of fallen crops. For at least ten hours a day, his head is turned towards the edge and he is constantly making small adjustments. It's clear that he doesn't have the strength to do everything.



ROTOR  
SPEED

SLOW DOWN

KEEP THE  
DISTANCE

CONTROL THE  
FEEDERHOUSE

FINISH TILL  
NIGHT

HOLD THE  
EDGE

AVOID THE  
TREE

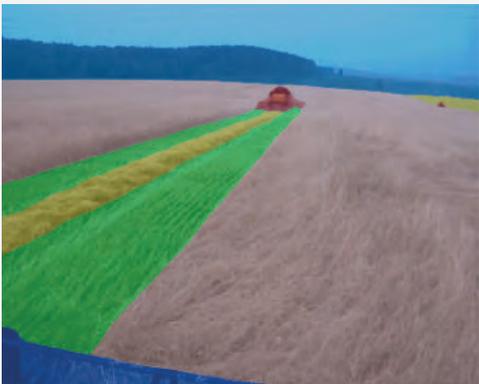
CONTROL  
GRAIN  
CONDITION



# COGNITIVE AGRO PILOT – AN INTELLIGENT AGRICULTURAL ASSISTANT

This is why you need an assistant in the field who can remove the routine tasks of operating the machine from the operator. The Cognitive Agro Pilot, a robotic driver's assistant that can be trusted to drive, does just that. The result is simple: the most tiring work is handed over to the robot, which never gets tired, the driver can then monitor the quality of the harvest and minimize losses. In this way, he now has the strength and ability to harvest significantly more per shift.

## THE BACKBONE OF OUR SYSTEM IS— ARTIFICIAL INTELLIGENCE



Just like a human, our robot sees and understands the environment as it moves along. Video footage from the camera recognizes areas of mown and unmown crops, as well as uncut crops, edges, rows, swaths, people, other machinery, trees, power poles and other possible obstacles. Cognitive Agro Pilot creates a path for the harvester to follow and ensures it follows it accurately. If there is an obstacle on the way, the system signals the danger and can automatically stop.



Cognitive Agro Pilot drives the machine



The operator is focused on harvesting, sowing or cultivating the land

# ALL HARVESTING MODES IN ONE SYSTEM

The combine harvester works for up to five months a season, harvesting different crops as they mature.

**Cognitive Agro Pilot** handles all harvesting modes equally well



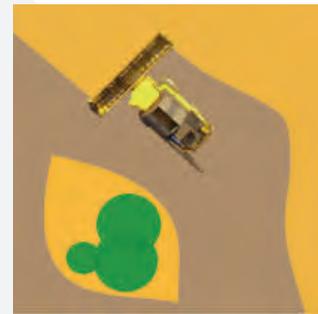
BY EDGE



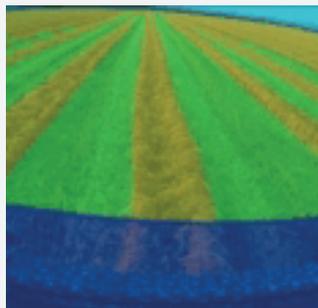
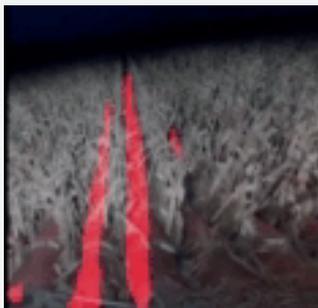
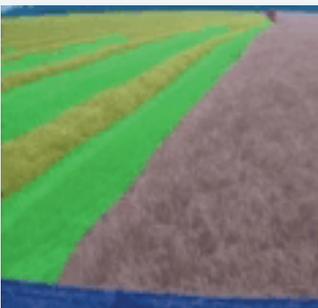
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BY WINDROW



OBSTACLES



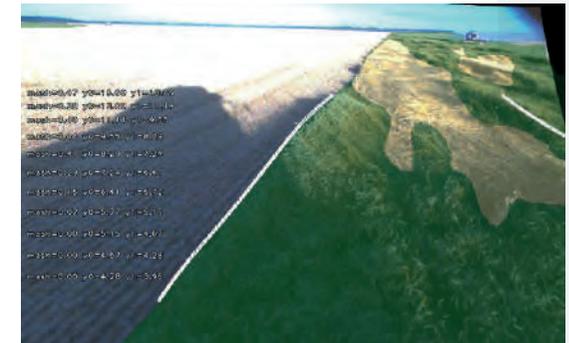
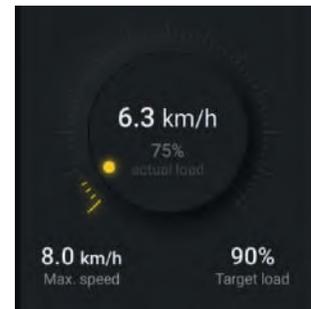
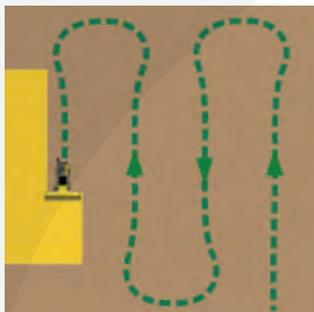
Under system control, the combine harvester confidently traverses edging, rows or swaths with a minimum cutterbar grip and 20 cm accuracy. Even when it is necessary to repeat the curves of the crop. The width of the cutterbar is fully utilized throughout the entire shift.

There is no need for precision GPS/GLONASS with costly RTK corrections, laser sensors, mechanical 'tendrils', etc.

Obstacles that can be encountered on the field are perfectly detected by the system, which will either warn the driver of the threat of collision or stop the combine harvester

## **EVEN MORE POSSIBILITIES WITH ADDITIONAL OPTIONS FOR 2021**

A set of optional extras offered this year will seriously push the boundaries of harvesting with autopilot.



### **ADDITIONAL CAMERA**

The combine harvester controlled by Cognitive Agro Pilot can now harvest on any edge.

### **SPEED CONTROLLER**

One of the most important parameters for accurate harvesting is the precise observance of the recommended speed. A dedicated digital module will automatically maintain the set speed and stop the combine. If it is necessary, the operator can easily take over control by turning the steering wheel slightly.

### **SPEED REDUCTION IN FRONT OF THE AREAS WITH A LODGED CROP**

It's quite common for farmers to harvest a lodged (downed) crop. To save your harvest, a specially developed for this purpose AI-based function allows you to pinpoint these areas and reduce the harvesting speed. A function specially developed for this purpose, based on Artificial Intelligence technology, allows you to pinpoint these areas and reduce harvesting speed so as not to lose the crop.

## WHAT IS INCLUDED IN THE KIT



### VIDEOCAMERA

Based on a state-of-the-art colour sensor designed specifically for transport applications. The camera is perfectly adapted to rapidly changing light conditions, shadows, dust and anything that obstructs good visibility. The camera is protected by a casing and held with a robust bracket.



### COMPUTING UNIT WITH AN INTEGRATED DISPLAY

The brain of the system. Based on a compact on-board neuroprocessor using vibration and temperature resistant components. The unit is protected by a sealed aluminium casing which protects it from shocks and moisture. Robust connectors allow connection of up to 4 cameras and other devices, as well as connection to the combine's CAN bus.



### POSITIONING AND NAVIGATION MODULE

Solves the tasks of positioning and assessing the dynamics of combine's movement, provides connection with a remote control center and other equipment on the field. The module is equipped with a high-precision dual-band GNSS Sensor, IMU Sensor, 3G/4G GSM Modem and a LoRaWan based unit.



### DIGITAL HYDRAULIC UNIT

Provides reliable steering in autopilot mode. Operates with the machine's standard hydraulic system.

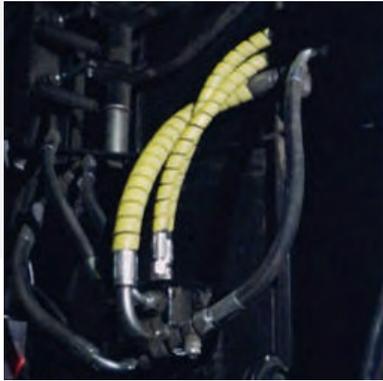


### WHEEL STEERING ANGLE SENSOR

Essential for driving on a set trajectory with a high degree of accuracy.

# INSTALLATION AND ADJUSTMENT

Installation is simple and safe for your combine's standard components.



**DIGITAL DISPENSING PUMP**  
in the hydraulic system



**TURNING SENSOR**  
on the steering wheel swivel unit



**CONTROL UNIT**  
under the cab



**POSITIONING AND NAVIGATION MODULES**  
mounted on the roof



**CAMERA**  
on the mirror bracket

Our dealer's team of qualified service engineers will install and configure the system within 2 days. Your combine harvester will then become a real robot, capable of harvesting more.

## NOW YOUR COMBINES ARE ALWAYS IN TOUCH

### During the harvesting campaign, every hour counts



Every farm manager or owner needs to make sure that the work goes accordingly to the plan. And if something has gone wrong, the information must come very quickly and be as objective as possible. In practice, unfortunately, this is not always the case. Often the manager is the last to know about problems or get the information with a long delay.

We have solved this problem. Cognitive Agro Pilot constantly transmits the data about the harvesting process from the combine harvester via the built-in GSM modem. If the combine is out of range, the data is stored temporarily on the onboard data storage device and is transmitted immediately to the central database when the connection is re-established.

Harvesting data is now literally in your pocket. With the Telegram bot that complements the system, you can get a set of individual or summary reports on harvesting progress, job location and tracks covered, as well as quick notifications when adverse situations arise.

## HARVESTING EXPERIENCE WITH COGNITIVE AGRO PILOT

During the summer and autumn of 2020, more than 300 harvesters under autopilot control on farms in over 20 regions of Russia proved in practice that our system can be installed on any combine model. The system is able to control the machine autonomously during harvesting of the vast majority of crops, operating steadily day and night.



Watch a video showing examples of how the Cognitive Agro Pilot system works on different harvesters, different crops and in different conditions.



## FEEDBACK FROM CLIENTS

### **Alexander Nesterenko, director**

The Cognitive Agro Pilot has shown itself to be a great success. I am satisfied. The system relieves the operator of stress and fatigue. It is especially important at night, because you have to be more attentive. We will buy the system and install it on other harvesters.

### **Dmitriy, mechanic**

It's 100% better with an autopilot. Before, if you needed to make a phone call, get a snack or a coffee, you had to stop. But now, you push a button and it drives itself, steers itself, and everything is fine. I don't get as tired as before. You just watch the main process. It works fine at night. The system has never broken down, there have been no failures. Of course, I recommend everyone to put it on other harvesters.

### **Andrey Tsegelny, mechanic**

The system warns if there is an obstacle on the way: a pole, a person or a large stone. And it also reduces harvesting errors by leaving no uncultivated areas on the field. This saves farmer's fuel and time.

### **Alexander Kuznetsov, project manager**

We need to relieve the machine operators. A man gets very tired after a long, monotonous day's work. Our cutterbars are quite large, 11 metres, and you have to watch them all the time to avoid catching a stone in the cutterbar, which can lead to breakdowns and costly repairs. That's why he doesn't steer, he just sits and watches the cutterbar, where it needs to be raised, where it needs to be lowered.

## FEEDBACK FROM CLIENTS

### **Eugene, mechanic**

*With the Cognitive Agro Pilot system it's easier, better and more convenient. You don't have to constantly look sideways to see what stays, what doesn't. You can concentrate on the process. The system works in poor visibility or on a downed crop. The interface is simple. It's a handy thing. I don't want to work without it anymore.*

### **Marat Islamov, manager**

*With the autopilot system, the quality of grain harvesting has also improved. Because the combine moves on its own, very precisely in the field. There are no skips, which can happen when driving 'manually'. The operators overlap up to 1.5m, especially at night. Now you can harvest during the day and at night.*

### **Anatoly Popov, farm manager**

*The impressions are great. This is the system of the future. This system should work on all harvesters and throughout the Orenburg region. It's easier for the combine operator to work. The system works for him. Reduces harvesting losses. 10 harvesters with Cognitive Agro Pilot work like 12 harvesters without it. Plus two combine harvesters of efficiency.*



## **GREAT BENEFITS AT A REASONABLE PRICE**

The Cognitive Agro Pilot system can help operator increase the harvesting output by around 20%. If, as an alternative, the purchase of an additional machine is considered, depending on the model, about 20% of the purchase price will be between \$20,000 and \$130,000 dollars.

That's why the \$9,500 dollars (excl. VAT) for the purchase of a basic system is a worthwhile investment in terms of profitability and efficiency of harvesting.

### **Cognitive Agro Pilot is installed as standard on "Gomselmash" and "Bryanskselmash" combine harvesters**

In Russia we are ready to offer our clients an option of leasing or lending the system at favorable rates as part of state support programmes for farmers. The standard product warranty is 1 year.



Cognitive Agro Pilot is a winner of **AgTech Breakthrough Awards** in "Overall Harvesting Innovation of the Year" nomination

# MAKE PROFIT IN THE FIRST SEASON

The system increases the combine's daily output, shortens the harvesting time and ensures that the grain, that is saved from shattering, goes into the farmer's storehouse.

In addition to generating additional income, the system also saves fuel through stable edge hold and the use of unloading on the go, which is now available to medium-skilled operators. And the system's ability to 'see' obstacles will eliminate repair losses and accident-related downtime.

This is clearly illustrated by an example:

## Raw data

|  |       |
|--|-------|
| Price per ton of harvest, \$                   | 170   |
| Yield, kg/hectare                              | 40    |
| Crop area to be harvested, hectares            | 5 000 |
| Number of harvesters in the fleet, units       | 10    |
| Cutter bar width of combine harvester, meters  | 9     |
| Harvesting speed, km/h                         | 4     |
| Shift duration, hours                          | 10    |
| Time-use factor for cleaning during a shift, % | 70    |
| Reduced harvesting time by using the system, % | 14    |

## Efficiency calculation

|   |         |
|---|---------|
| Estimated harvesting capacity without system, ha/shift                    | 25,2    |
| Days of harvesting without Cognitive Agro Pilot, days                     | 20      |
| Estimated harvesting capacity using the system, ha/shift                  | 28,7    |
| Days of harvesting using Cognitive Agro Pilot, days                       | 17      |
| Value of reduction in shattering losses due to shorter harvesting time, % | 5,00    |
| Amount of reduction in crop losses per 1 ha, \$                           | 35      |
| Total amount of reduction in crop losses, \$                              | 175,000 |
| Amount of effect per harvester, \$  | 17,500  |

# AN INFORMED CHOICE OVER THE COMPETITION

In creating and developing the system, we have tried to take into account everything our customers need to ensure that their purchase will have the expected effect.

| Criteria for comparison   | Agro Pilot | Systems with technical vision (have a camera as part of it) | Parallel driving systems (common GPS-based systems on the market) |
|---|------------|---|---|
| Traffic management  | ✓          | ✓   | ✓   |
| Fits on any combine harvester                                     | ✓          | only one vendor   | ✓   |
| Digital hydraulic unit included                                   | ✓          | only car with preparation                                   |   |
| No need for RTK in the field                                      | ✓          | need to carry a base station                                | —   |
| Leading the harvesting by sight                                   | ✓          | GPS operation   | GPS operation   |
| Row leading with any cutter bar                                   | ✓          | straight on the GPS   | straight on the GPS   |
| Edge/roll movement  | ✓          | —   | —   |
| Satellite-guided harvesting independence                          | ✓          | only one vendor   | only car with preparation   |
| Speed control on combines from different manufacturers            | ✓          | —   | —   |
| Repeating the cleaning pattern behind the combine harvester ahead | ✓          | —   | —   |
| Automatic corner detection while harvesting                       | ✓          | —   | —   |
| Sending telemetry to common ERPs                                  | ✓          | proprietary only  | proprietary only  |
| Presence of vision  | ✓          | only for collision monitoring                               | —   |
| Identifying artificial and natural obstacles                      | ✓          | ✓   | —   |

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