



The Russian Federation
Nizhny Novgorod State Technical University named after R.Y. Alekseev
Transport Systems Institute

The Research of Indexes of Operational Characteristics of Electric LCV

Tumasov Anton - presenter

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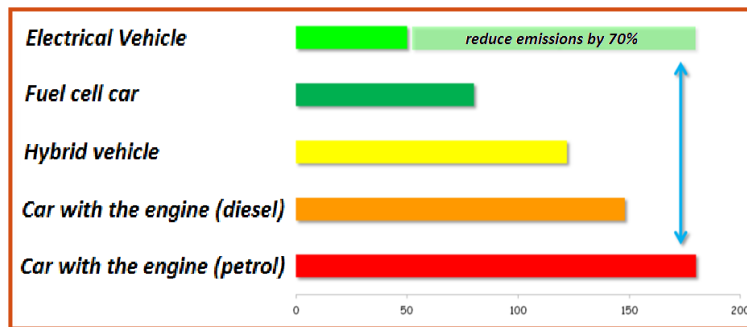
Shatilov Alexey, Yarzhemsky Alexey

NNSTU – the best traditions of Soviet and Russian engineering school



CO2 emissions g/km

Source: JHFC, Mitsubishi Motors



Russia – is one the largest markets by sales volume of new commercial vehicles

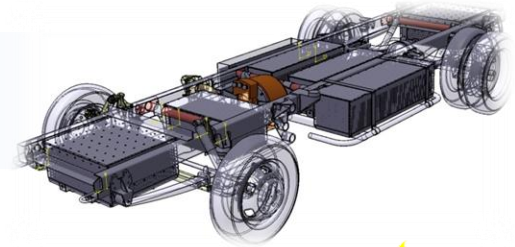




Model	Modec	Edison	EcoDaily Electric 35S	Ford Transit Electric
Max.Engine power kW (HP)	76,1 (102)	90 (120,6)	Nom. 30 (40) High. - 60 (81)	55 (280)
Weight: Gross weight, t Payload, t	5,49 2,0	3,5 or 4,6 1,22 or 2,3	3,5	3,5 0,7
Max. Speed , km/h	80	80	70	120
Tyres/ wheels	205/75R17,5	205/75R16 or 185/75R16	195/75R16	205/65R16 , 195/70R15
Types of battery	Custom	Lithium Ion Iron Phosphate (Li Fe PH ₄)	sodium-nickel chloride battery	Lithium ion
Battery capacity kWh	60	40	n/a	28
Transmission	Continuously variable transmission (CVT)			
Single charge distance km	160	160	90-120	130

1

Space-saving and **unitized** chassis of electric vehicle for the wide range of “vehicle family”



2

High level of **electric safety** and reliability, that minimize the probability of a shock hazard and a fire (in case of road accident)



3

Multipurpose **modular intelligent operational system** for the electric vehicle, that could be used for different modifications of the EV

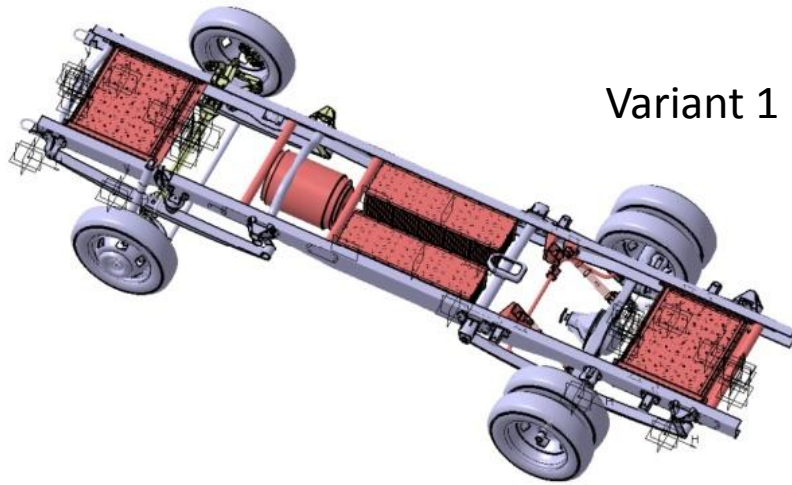


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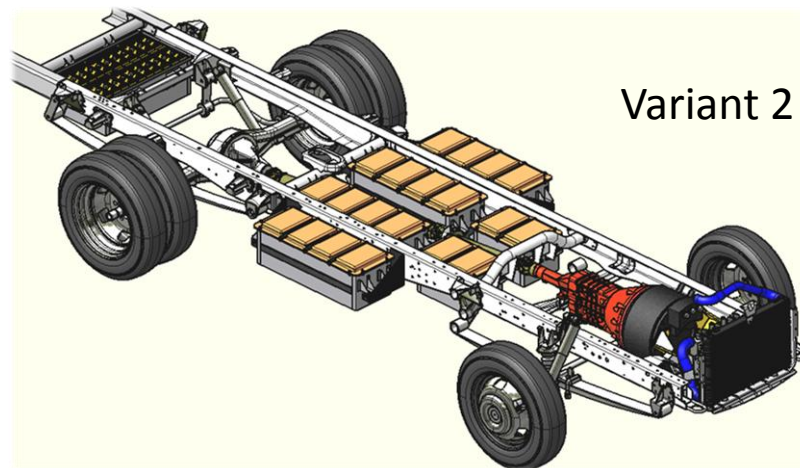
The adaptation of vehicle parts for Russian severe climatic conditions (**low temperatures**)



LCV electro chassis design (two variants)



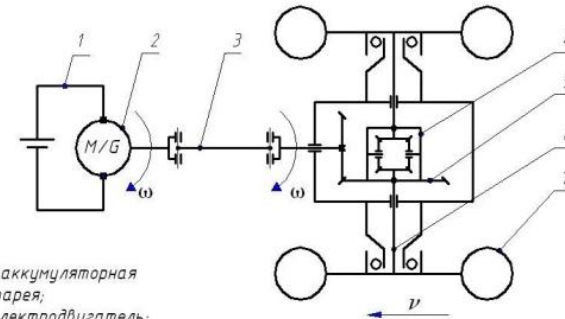
Variant 1



Variant 2

R&D activity:

- Chassis design
- Development of mounting parts
- Development of electric operational system
- Development of software
- Development of mechatronic parts and sensors (radars, positioning systems)



- 1 - аккумуляторная батарея;
2 - электродвигатель;
3 - карданная передача;
4 - дифференциал;
5 - главная передача;
6 - полуось;
7 - колесо.



Main theoretical haulage speed properties

Characteristics	Type of electric engine							
	Siemens 1PV5135-4ws24	Siemens 1PV5135-4ws28	AZD AC55	AZD AC 90	UQM 125	Remy HVH 250	UQM PP 200	UMZ-4216
Max. Speed ,km/h	95	115	80	90	96	86	122	115
Max. Climb %	34	25	23	25	23	23	36	34
Acceleration time to 60 km/h	6,7	8,5	18,0	9,7	8,7	10,8	6,0	12,4
Acceleration time to 80 km/h	10,2	12,5	—	24,0	12,5	21,0	9,0	21

Energy consumption of the accumulator battery

$$W = W_c - W_r = \frac{\int P_{s_tr} dt}{\eta_{s_tr} \cdot \eta_{c_disch}} - \eta_{c_ch} \cdot \eta_{s_gen} \cdot \int P_{s_gen} dt$$

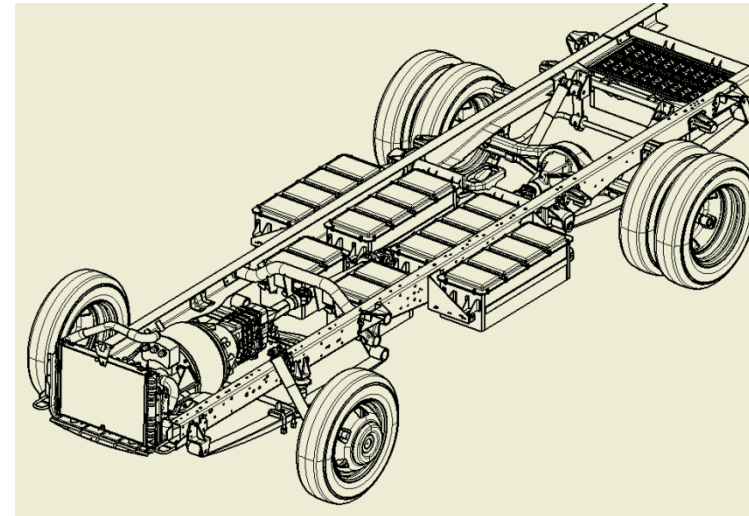
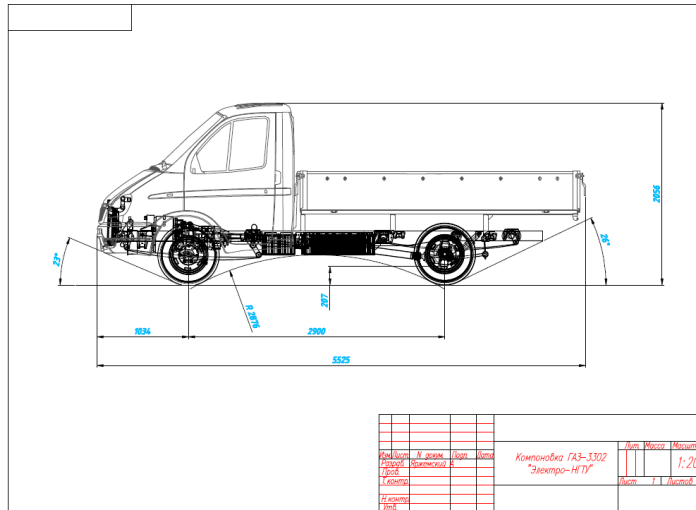
Theoretical run on a single charge in a city mode of movement: L=160 km

where η_c – the utilization of the battery (accumulator); η_c – motor efficiency; P_s – power on the motor shaft, W_r – energy recovery, W_c – total energy consumption in the urban cycle. Additional indices, respectively, for the motor: tr – traction mode; gen – generator mode, for battery: ch – charging mode (recovery), disch – discharging mode (traction).

LCV electro – test prototype (variant 1)

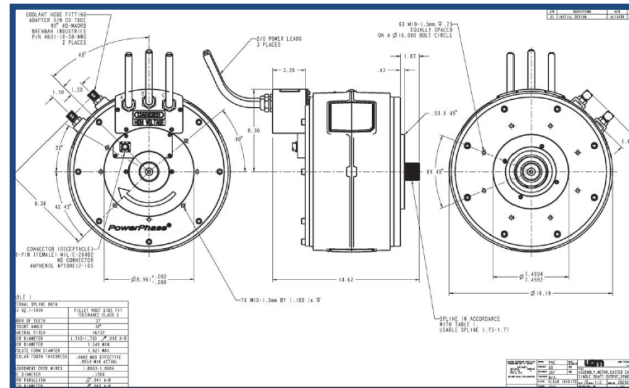
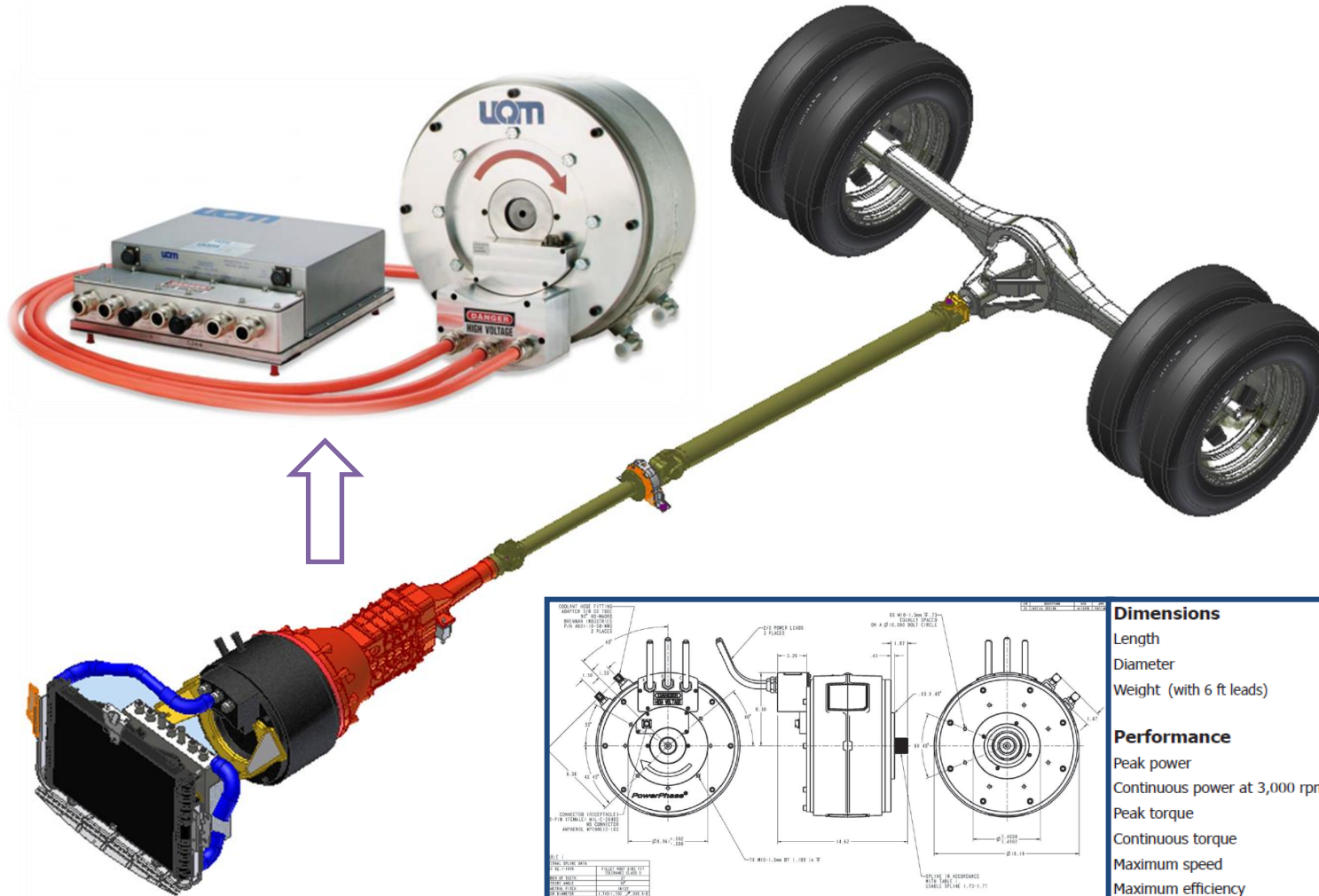


Gross weight, kg	3500
Payload (no less than), kg	900
Chassis weight(with driver) no more than,kg	2200
Engine type	Permanent magnet synchronous motor
Max power, kW	200
Max Turning torque, Nm	850
Max rotating rate, r.p.m	5700
Accumulators	Lithium Iron Phosphor Fe ₂ PH ₄ , 56 kWh
Max speed, km/h	100
Max climb, %	36
Acceleration time to 80 km/h , sec	9,0
Single charge distance, with a full load ,summertime, km	145



Technical specification of EV	«GAZ - 3302E»
Gross Weight, lbs	7716
Load Capacity, lbs	1984
Maximum Speed, mph	60
Mileage without recharging at full load, miles	60
Engine Type	BLDC
Engine Power Rating, (continue/peak), kW	115/200
Storage Batteries	Winston Battery LiFePO4
Energy Intensity of batteries, kWh	33

LCV electro chassis design (variant 2) – electric drive




Dimensions		
Length	9.49 in	241 mm
Diameter	16.19 in	411 mm
Weight (with 6 ft leads)	208 lb	95 kg
Performance		
Peak power	268 hp	200 kW
Continuous power at 3,000 rpm	154 hp	115 kW
Peak torque	664 lbf•ft	900 N•m
Continuous torque	331 lbf•ft	450 N•m
Maximum speed	5500 RPM	
Maximum efficiency	94%	
Power density (based on 200 kW)	1.29 hp/lb	2.12 kW/kg

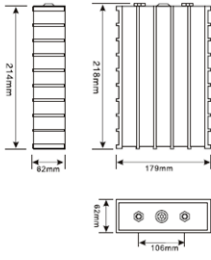


溫斯頓牌稀土鋰鈮動力電池性能說明
SPECIFICATION FOR WINSTON RARE EARTH LITHIUM TITANIUM POWER BATTERY

**電池尺寸
DIMENSIONS**



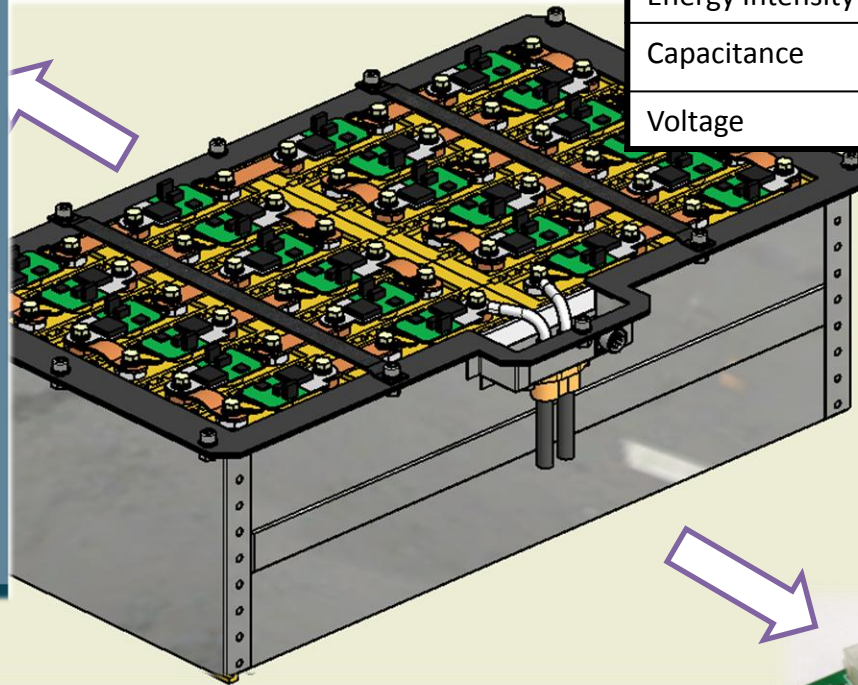
型号(MODEL) WB-LYP100AHA



**技術參數
SPECIFICATIONS**

型號(MODEL): WB-LYP100AHA

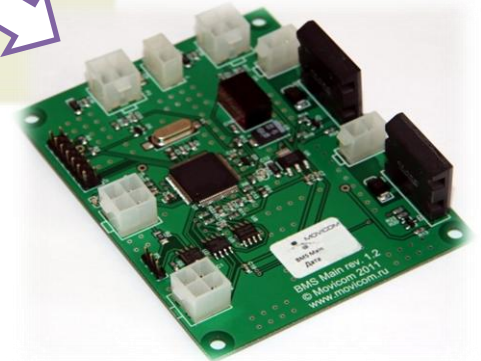
標稱容量 Nominal Capacity	100Ah
工作電壓 Operation Voltage	充電 (Charge) 4.0V 放電 (Discharge) 2.8V
最大充電電流 Max Charge Current	≤3CA
最大放電電流 Max Discharge Current	恒電流 (Constant Current) < 3CA 脈衝式 (Pulsed Current) < 20CA
標準充電電流 Standard Charge/Discharge Current	0.5CA
循環壽命 Cycle Life	(80DOD%) >3000Times (70DOD%) >5000Times
殼體耐溫性 Temperature Durability Of Case	≤200°C
適應環境 Operating Temperature	充電 (Charge) -45°C~85°C 放電 (Discharge) -45°C~85°C
自放電率(月) Self-discharge Rate	≤3% (Monthly)
單體電池重量 Weight	3.5kg ± 100g



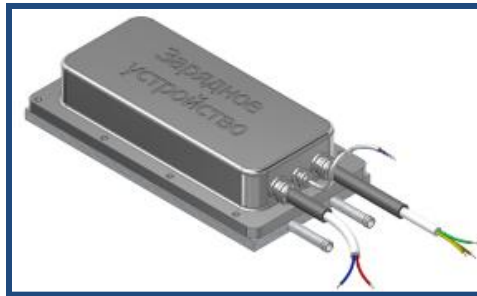
TRACTION BATT characteristics	
Energy Intensity	33 kWh
Capacitance	100 Ah
Voltage	330V

BATTERY CELLS
«WINSTON BATTERY»

BMS «MOVICOM»
BATTERY
MANAGEMENT
SYSTEM



ONBOARD CHARGER



«ELTECK VALERE»
3kW CHARGER

EXPRESS CHARGE



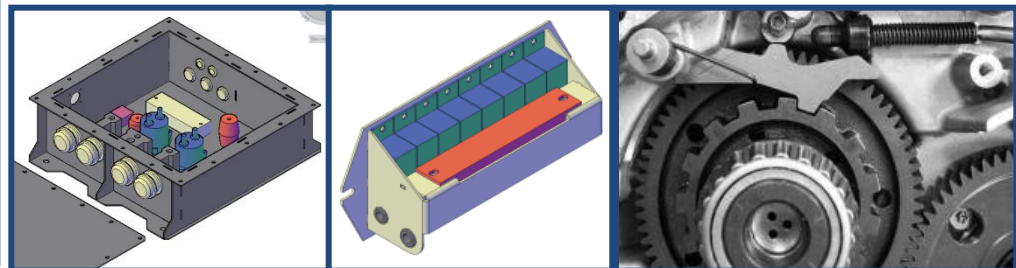
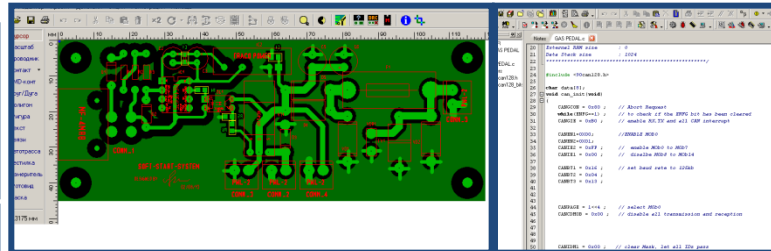
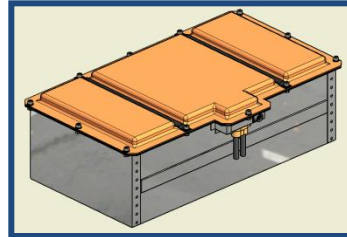
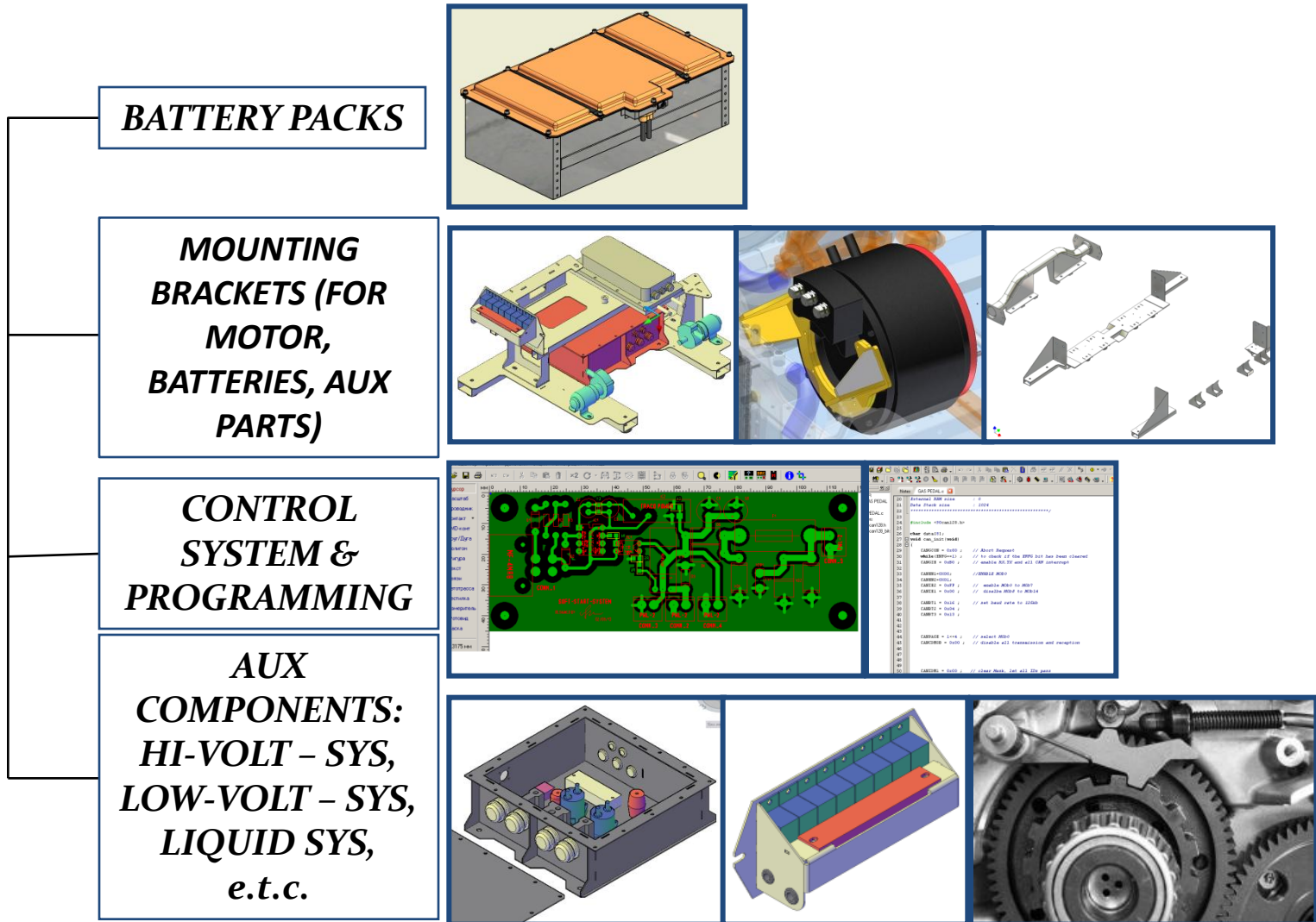
Onboard CHARGE SYSTEM characteristics

Max Power	3 kWh
Input Voltage	180 ... 270 V
Min Charging Time	10 Hours

EXPRESS CHARGE SYSTEM characteristics

Max Power	40 kWh
Min Charging Time	1 Hour

LCV electro chassis design (variant 2) – self-development component



1. The analysis of technical characteristics of the best world analogs of the electric LCV was carried out. Values of indicators of the main operational characteristics were established: single charge distance in summertime 130 - 160 km. the maximum speed - 80-100 km/h, loading capacity -0,7 - 1,2 t.
2. NGTU of R. E. Alekseev (Russia) has developed and made the experimental sample of the electric LCV car which technical solutions are protected by patents of the Russian Federation for utility models.
3. As a result of theoretical and pilot studies it is established that on indicators of dynamics and speed properties the electric car "NGTU-Elektro" are at the level of a pilot model with the gasoline engine and doesn't concede to the best world analogs of electric cars of this class. A single charge distance and the loading capacity of the vehicle are at the level of the considered world analogs.
4. The conducted researches allowed to estimate economic efficiency of use of LCV cars in Russia in comparison with diesel and petrol analogs. The payback period of the LCV cars will make (depending on the initial cost of vehicles) no more than 7-10 years.



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Thank you for attention!

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