



Electric aircraft innovation in Czech Republic & EU/China GA cooperation 捷克电动飞机创新及中欧通航合作

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e-flight Forum, Beijing, November 2017
e-flight Forum, Beijing, November 2017



捷克共和国航空管理部门

- 根据附件二第 e), f), g) 段，捷克民航局和捷克轻型飞机协会分管相关责任。

捷克轻型飞机协会负责

450/472,5kg 超轻型飞机
& 600kg 实验轻型运动飞机
& 560 kg 旋翼机



MTOM < 450 kg

捷克民航局负责 所有其他航空器



MTOM > 450 kg

LAA ČR Certification Approach

LAA 的机型审定程序

- Airframe 机身
 - standard LAA CR certification process is used
 - 按照标准的 LAA 审定程序执行
 - Category ULL or ELSA 超轻机或实验类轻型运动飞机类别
- Powerplant 发动机
 - Methodology for instalation of electric powerplant to small aircraft was developed based on ASTM2840-11 and it is used - M/EPOS-2013
 - 轻型飞机上如采用电动机，按照 ASTM2840-11 M/EPOS-2013 标准审定
- Common sense approach is used
- 按照通常惯例原则

MTOM 600 kg NOW or NEVER!

Czech Republic's proposal on Annex I with regard to aircraft referred to in Article 2(3)(d) of the revision of EASA Basic Regulation

Problem of current ultralights:

$$\begin{array}{ccccc} \text{MTOM} & - & \text{Empty Aircraft} & = & \text{Payload} \\ 450 \text{ kg} & - & 304 \text{ kg} & = & 146 \text{ kg} \end{array}$$

Not Enough Payload!

Our solution: realistic payload for the existing Ultralights

$$\begin{array}{ccccccc} \text{Empty Aircraft} & + & \text{Pilot + Passenger} & + & \text{Fuel/Baggage} & = & \text{MTOM} \\ 350 \text{ kg} & + & 200 \text{ kg} & + & 50 \text{ kg} & = & 600 \text{ kg} \end{array}$$

Simple, easy to understand!
No need for new regulations!

Projects under LAA ČR responsibility LAA 负责的电动飞机项目

1. E-glider.com PPG
2. EGO trike
3. E-Song – LAA Type Certified
4. D-14 – PhoEnix
5. ΦNIX - Electro powered airplane with range extender
6. Sagitta
7. Sportstar Epos
8. SKYLEADER 400 electro
9. GyroMotion

E-glider.com



Electric paraglider – already sold 11 units

Electric engine NT-power „M“ output power 15kW

Size "M" diameter 200mm

Controller 400 A/70V,

battery type 9,5kg, 25Ah Li-Pol, 14S 5P 20-30C, peak voltage 58,8V,

charging time 45-60min,

flight time 20min



Ego Trike



ULTRALIGHT DESIGN

EGO TRIKE

EGO trike is light, fully composite one seater, or from 2015 also tandem, designed for ATOS gliders. For its aerodynamic cleanliness is especially suitable for flying in thermals with very low fuel consumption. Complies with German DULV 120 kg regulation. Partially disassembled fits into a car for transportation. Petrol or electric versions available.

Wheel track 1500 mm, w. base 1700 mm, transport size :1750 x 430 x 750 mm
MTOM 213/320 kg,
cruising speed 60-90 km/h (ATOS VR),
minimum sink rate 0,8 m/s (engine off).

ULTRALIGHT DESIGN s.r.o.

Žitavská 361/II,
471 54 Čvikov, Czech Republic

www.ultralightdesign.cz

info@ultralightdesign.cz

Electric engine REX 30,
MGM COMPRO Controller 500 A,
battery type LION 2 x box 110 Ah , 58 V, pack= 616 pc LG CHEM 3500mAh,
154Ah / 58V. Two packs are used. Weight 33 Kg, flight time 120min

e-Song



GRAMEX

SONG LW/ E-SONG

A single-seat, carbon-fiber composite aircraft for the 120 kg category. powered by Polini 250LC (36hp) engine. Electric version e-Song is powered by Rotax Rex300/2/3 (18kW) engine and it is LAA CR Type Certified. Song complies with US Part 103, UK's SSDR and German 120kg categories. 22 aircraft have been built so far.

Span 11,2 m, length 5,9 m,
wing area 10,50 m²,
empty weight 120kg,
(e-Song 106kg + 2x13kg battery)
MTOM 235 kg,
maximum speed 140 km/h.

GRAMEX, s.r.o.

Zbraslavice 399, 285 21 Zbraslavice,
Czech Republic
www.airsport.cz
e-mail: info@gramex.cz

TC ULL – 02 / 2013 b from 29.3.2016

Electric engine REX 30,
Controller 500 A,
battery type LION 2 x box 110 Ah , 58 V,

D-14 PhoEnix



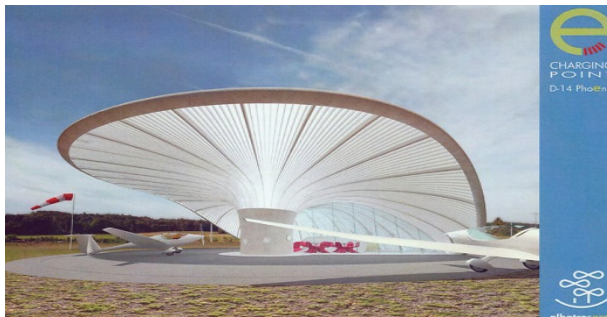
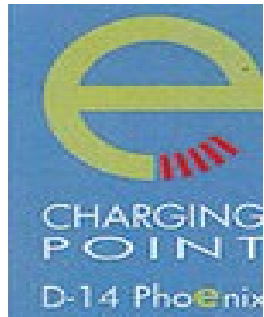
Phoenix Air

D-14 PhoEnix

A composite structure, mid-wing configuration, two seat, side-by-side, electric motor glider. The tail-dragger type landing gear is retractable. Powered by a Kral 44 kW electric engine with a two-blade adjustable/feathering propeller produced by Phoenix Air.

Span 14,46 m, length 6,50 m,
empty weight 300 kg,
wing area 10,08 m²,
speed VH 220 km/h,
cruising speed 180 km/h,
glide ratio 36:1

Phoenix Air, s.r.o.,
Lochmanova 64,
562 01 Ústí nad Orlicí,
Czech Republic
www.phoenixair.cz
e-mail: info@phoenixair.cz



New idea of e-Charging point
Charging by means of common connector cocket with
parameters 380V/16A,
Expected 1 hour charging time
Necessary facilities for waiting pilots

ΦNIX - Electro powered airplane with range extender

ΦNIX



Payload: 200 kg Minumum range: 400 km Cruise speed: 160 km/h

Sagitta



Carbon composite sailplane prototype built by Radovan Hučík

Electric engine REX 30,

Span 11m

Empty weight 100 kg

MTOM 225 kg

SportStar Epos



EVEKTOR-AEROTECHNIK

SPORTSTAR EPOS+

An all-metal side-by-side two seat LSA aircraft driven by an electric motor. The power unit is compact and powerful DC electric motor RE BB90-5 delivering 75 kW from Rotax Electric, engine performance is controlled by an electronic control unit. Project was designed with financial support of TA ČR.

Span 10,5m,
length 5,98m,
MTOM 600 kg,
cruising speed 150 km/h.

Evektor-Aerotechnik, a.s.,
Letecká 1384, 68604 Kunovice,
Czech Republic
www.evektoraircraft.com
e-mail: sales@evektor.com

LAA ELSA category – MTOM 600kg



SKYLEADER 400 ELECTRIC



ENGINE

MGM COMPRO RE80 /

MGM COMPRO RE65

Power Continuous: **up to 65 - 80kW**



Maximum horizontal velocity: **205 km/h**

Rate of Climbing: **3,5 m/s**

Cruising speed: **170 km / h**

Range on full battery: **300 km**

Weight - empty with full battery: **490 kg**

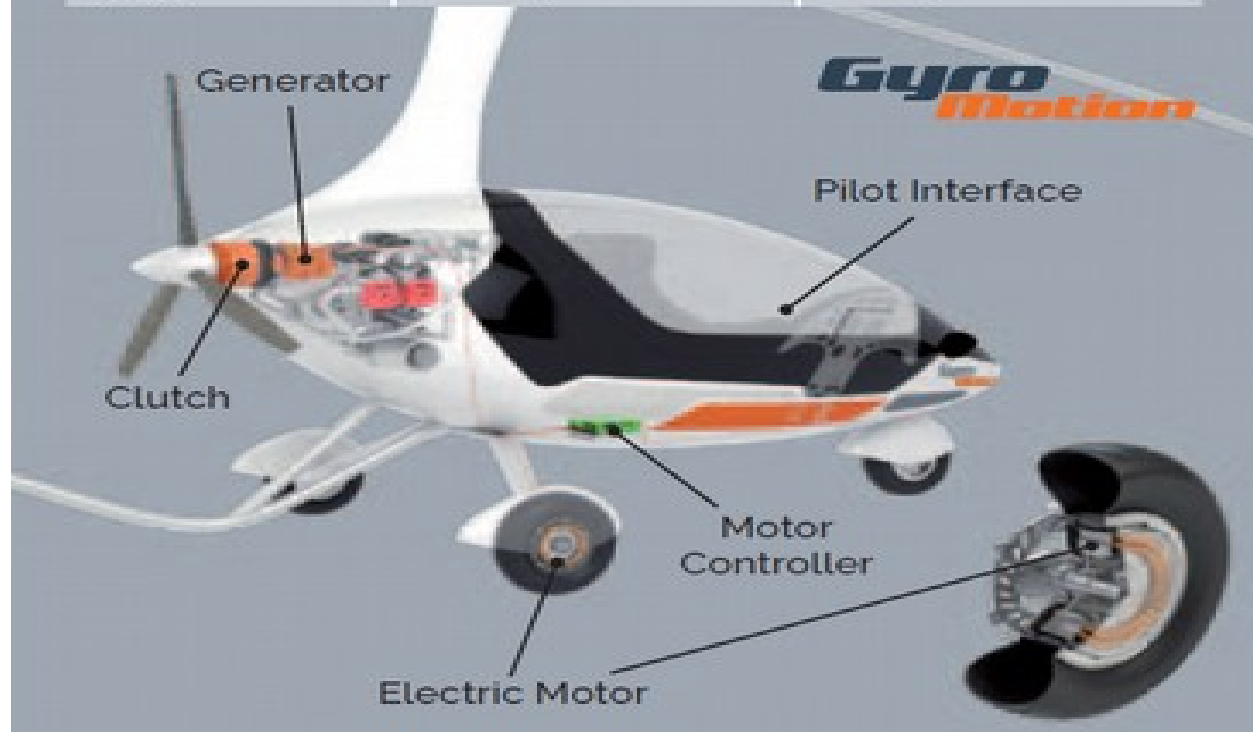
- empty with half battery: **380 kg**

GyroMotion

Gyro Motion

World premiere of unique concept of electrically powered roadworthy gyroplane.

	Electric Drive	Hybrid Drive
Power	3 kW. Peak 12 kW	
Peak Torque	150 Nm	150 Nm
Battery	Li-Ion, 1.8 kWh	—
Range	20 km	Unlimited
Gradeability	10 %	10 %
Vmax	40 km/h	40 km/h



Electric Propulsion System

MGM-RE 100+ HP



MGM COMPRO A ROTEXELECTRIC ELECTRIC PROPULSION SYSTEM **MGM-RE 100+ HP**

MGM COMPRO and RotexElectric have developed industrial electric propulsions for aircrafts, gliders, paraglides, multicopters etc. Units with 1kW-80kW have low weight, high performance and a long flight range.

Fully featured replacement for Rotax 912 100 HP

Measures: 270x203 mm

Weight: 22 kg

Power (permanent): 80 kW

Efficiency: 92-96%

Speed Controller: 130x250x215 mm

Measures: 4.9 kg

Weight: 80 kW

Power (permanent): 99%

Efficiency:

MGM COMPRO s.r.o.

www.mgm-compro.com

m.dvorsky@mgm-compro.com

Tel.: +420 602 832 913

RotexElectric



The company RotexElectric is a professional industrial producer of high-end BLDC (PMSM) electric drives for aviation industry.

Our engines have power ranging from 1kW up to 80kW. Their application is in aeroplanes, gliders, paraglides, multicopters etc. Our motors are remarkable for their high permanent power, low weight, top quality and high efficiency.



RotexElectric

Luboš Chvátal
Kociánova 1587 Praha 5
Czech Republic

Tel: +420 607 954 648
mailto:rotexelectric@gmail.com
www.rotexelectric.eu

Rotex engines used on various projects:

UL glider Saggita, E-Fan, UL Archeopteryx, PPG Paracell, PPG Vittorazi, personal tricopter FLIKE and a lot of others in prototype stage.

MGM COMPRO



MGM COMPRO



MGM COMPRO Company is focused on production and development of top-of-the-range solutions for industrial applications of BLDC a PMSM electric motors. We also develop and produce tailor-made products and import high-quality industrial batteries.

Unique Battery Management Systems (BMS) for energy storage in battery systems, industrial chargers etc. are also our spheres of activity.

MGM COMPRO

Růžová 307

763 02 Zlín

Czech Republic

tel.: +420602832913

e-mail: info@mgm-compro.com

www.mgm-compro.com

NT-power.eu

BLDC motors are available with the values of 12, 15 and 18kW for the output power. All the motors are equipped with sensors for reading the rotor's magnetic field, which is necessary for efficient controlling of the motor, especially for high values of torque and for low-speed start-up.

Size "M" diameter 200mm
output power 10,12,15,18kW
Size "L" diameter 300mm
output power 30,32,35 kW
Under development:
Size "S" diameter 110mm
output power 6,8,10kW

Already sold more than 60 pc
M size, all around the world

Under testing – rescue system for
Single seat helicopter based on
15kW engine but with output power 34kW for 30-40sec



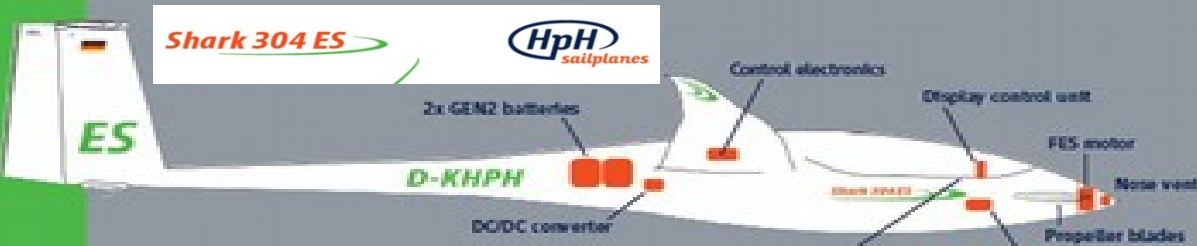
Projects under Czech CAA and EASA responsibility

捷克航空局和欧洲航空安全局负责的项目

- 1. HPH e-Shark**
- 2. KKB 15**
- 3. VUT 051 Ray**



HPH Shark 304 ES



Shark 304 ES

HpH sailplanes

ES

D-KHPH

Control electronics

Display control unit

FES motor

Nose vent

2x GEN2 batteries

DC/DC converter

Propeller blades


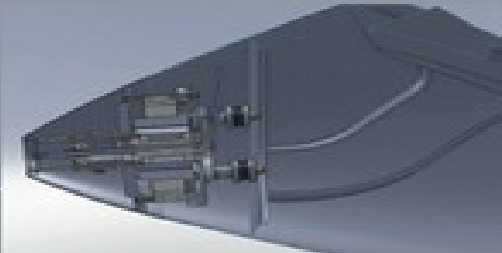

12V PB battery

Canopy Open safety switch

FRONT ELECTRIC SUSTAINER (FES)

FES SYSTEM COMPONENTS

Using experienced gained during development of the Certified FES System, LZ Design were able to work with HPH to determine the best way of adapting the Shark sailplane to offer the electric "Self-Retrive" capability.

TECHNICAL DATA

SHARK 304 ES 18m

GEOMETRY

Wing span	18 m 59 ft
Wing area	11,8 m ² 127 ft ²
Aspect ratio	27,43
Fuselage length	4,79 m 15,72 ft

WEIGHTS

Empty weight	340 kg 750 lb
maximum take-off weight	400 kg 882 lb
Water ballast	200 l 52 US gal
Min. wing loading	37 kg/m ² 7,5 lb/ft ²
Max. wing loading	51 kg/m ² 10,4 lb/ft ²
Cockpit range	70-110 kg 154-242 lb

PERFORMANCE


Best glide ratio	> 50
at speed	125 km/h 67,5 kt
max. sink rate (at min. weight)	0,52 m/s 104 ft/min
at speed	66 km/h 36 kt
Climb Rate with FES	1,5-2 m/s

LIMITATIONS

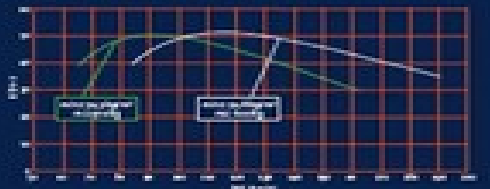
Stall speed (at max. weight)	88 km/h 47,5 kt
V _{NE}	240 km/h 140 kt
Range with FES	~100 km

Performance is based on calculation data.

SPEED POLAR SHARK 304 ES 18m



L/D POLAR SHARK 304 ES 18m



ENGINE SYSTEM

Battery Technology	LiPo GEN2 system
Battery Weight	35kg 77 lbs
Maximum Power	23 kW
Maximum RPM	4500

WWW.HPH.CZ

EASA.A.030 TC received 21.11.2016

15 flying



KKB-15(18)



Kusbach - Bartoník

KKB-15 (18)

A single-seat experimental high performance competition glider of all-composite construction with elliptical wing and horizontal tail for aerodynamic efficiency. Equipped with single-wheel retractable landing gear and water ballast tanks for 150 liters. Flying 18m version. Motorization under development. (2 gliders have been manufactured so far.)

Span 15,00 (18,00) m, length 6,43 m, wing area 10,01 m², MTOM 500 kg, max. speed V_{NE} 250 km/h, glide ratio 45:1 (48:1) at 133 (111) km/h.

Kusbach - Bartoník,
769 01 Holešov,
Očadlíkova 36,
Czech Republic
e-mail: obartonik@volny.cz

REX 30 engine used as „range extender“

VUT 051 RAY



Brno University of Technology project

Combined structure (composite, metal) single seat, single engine (53kW).

Span: 9,9 m

Length: 8,133 m

Height: 2,447 m

MTOW 600kg

Endurance >1h

53kW custom built engine (Aveko)

3060 Li-ion cells in serial-parallel connection

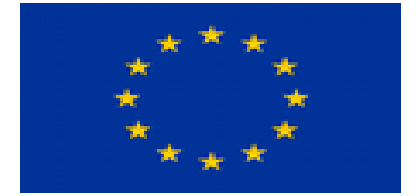
Maiden flight under supervision of Czech CAA on 20.8.2014 (aircraft received Special Certificate of Airworthiness).

Flight test phase waiting for financing.



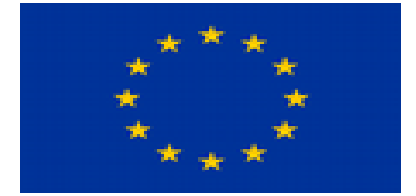
EU-China GA Negotiations

中欧通航合作项目



- **Bilateral Aviation Safety Agreement**
- **双边安全合作协议**
 - essential for any aviation business between EU and China
 - 作为中欧航空项目的基础性协议
 - difficult to predict the timeline
 - 时间表未定
- **Working arrangements**
 - bilateral level
 - company level

EU-China GA Negotiations



- **EU-China Aviation Partnership Project (EU-China APP)**

- started recently
- duration 5 years (2015-2020)
- EU funds of 10 million euros
- managed by EASA
- implemented together with CAAC
- www.eu-china-app.org



EASA-CAAC Project Preparation—January 2016

- Focus on activities of mutual interest in these areas:

- **共同关心的主要议题**

- Airworthiness 适航
- ATM/ANS and airports
- Aviation Safety and Security 航空安全
- Environmental protection 环保
- Economic policy and regulation 经济性政策
- General aviation 通航

1956 年捷克 - 中国航空合作

捷克-中国合作的 开端

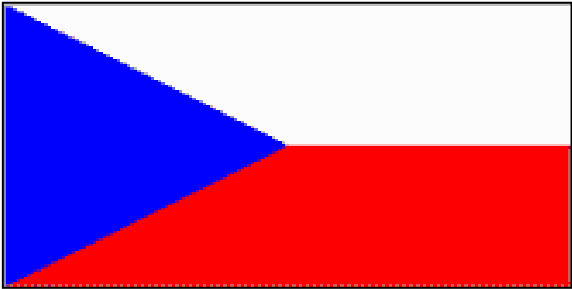


Aero Ae-45在中国的使用

精英的飞行表演

昨天，在由捷克人民和中国人民组成的“五一”国际劳动节期间，在首都的民用机场举行了2,500多名工人、干部、学生和青年官兵。他们观看了捷克空军在首都机场举行的飞行表演。表演中，一架双引擎的“波博”飞机在空中进行了精彩的飞行表演。这架飞机在空中进行了各种特技动作，包括低空飞行、爬升、俯冲、翻滚等。观众们对这次精彩的飞行表演表示赞赏。捷克空军在首都机场的飞行表演，展示了捷克空军的实力和水平。这次飞行表演也进一步加深了中捷两国人民之间的友谊和了解。

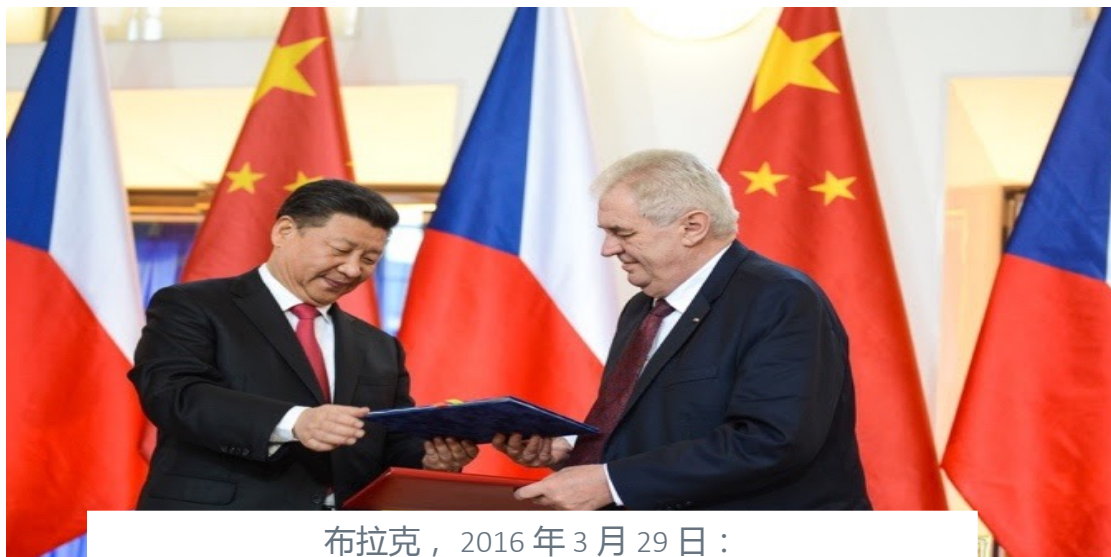
《南方都市报》有关捷克飞行员的报道



捷克机械工业与中国及中国企业的合作已有多年的历史。早在1954年于埃根举行的捷克斯洛伐克博览会上，中国企业就参观了捷克的飞行员和飞机。当时，捷克参加展出的产品包括三种飞机：搭载1名飞行员和3名乘客的小型双引擎双引擎Aero Ae-45、两座训练和特技飞行用飞机 Zlin Z-126 Trepas 2 以及两座初级滑翔机LP-109 Pionyr。这些飞机由经验丰富的飞行员Adolf Koblizek驾驶。运动型飞行员和飞机机械师Svatos协助飞行。两人尽力完成了精彩的飞行表演。Koblizek驾驶动力飞机做出了令人震撼的特技表演，又驾驶Pionyr做出了潇洒的盘旋动作。当时，埃根体育场馆内聚集了55,000名观众。多名专家和贵宾受邀在当地机场进行观摩。捷克飞行员还让前来展示飞机模型的儿童和体验者参与了驾驶体验。这是一次成功的捷中航空合作盛会。请容我们再补充几句，中国对双引擎Aero Ae-45并不陌生。Ae-45用作小型运输机，也可用于其它用途，包括森林火灾监控。自那时开始，有更多的捷克飞行员和飞机引入了中国，两个国家的新媒体均对这次特殊的盛会以及两国人民结下的友谊进行了正面报道。这场盛会可被视为“捷克与当时的新中国及其航空业开始伙伴关系正确方向上的大力迈进”。怀着同样积极合作意愿，您刚才看到的捷克航空产品目录就此诞生。



航空合作已经成为捷中两国战略合作的一部分



布拉克，2016年3月29日：
《中华人民共和国和捷克共和国关于建立战略伙伴关系的联合
声明》签署仪式



布拉克，2016年3月29日：
轻型飞机认证双边协议签署仪式



北京，2016年6月17日：
李克强同捷克总理索博特卡举行会谈



北京，2016年6月16日：
捷克总理索博特卡会见冯正中国民航局局长冯正霖交谈

捷克与中国民用航空局的合作



珠海，2016年11月



布拉克，2016年10月



北京，2017年5月



北京，2017年5月

与中国民用航空局的成功合作

- 捷克交通部与中国民航局签署双边技术协议，由捷克轻型飞机协会（ LAA ）负责具体实施
- 捷克共和国总理索博特卡同中国民航局局长会见
- 中国民航局副局长王志清先生访问捷克
- 捷克交通部同中国民航局签署合作备忘录
- 中国民航局为捷克 JA-600 和 Alto 和 FM250 和 Shark 颁发 VTC
- 中国民航局批准允许捷克 F-AIR 航校为中国培养飞行员
- 邀请中国民航局适航部门、飞行标准部门、以及运输部门参加在捷克举办的工作研讨会

谢谢！

联系方式：fridrich@laacr.cz
www.czechaviation.info

