



# Whitepaper

AVINOC - The Blockchain Solution  
disrupting the global General Aviation Business

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## Abstract

In Business Aviation (BizAv), a part of general aviation (GA), processes and their optimization are still receiving insufficient attention - even today. Digitization and possible automation are slow due to the large number of different solutions and complex structures. In many places, the coordination of flights, orders and customer and supplier management are effected manually or are only slightly information-based (e-mail, Excel, paper) using a multitude of incompatible systems containing non-integrated structures. In order to close the resulting gaps in communication and information management, intermediaries are employed. On further consideration, however, this need in itself is only a symptom and the causes are more deeply hidden. The effects are usually high costs associated with a large overhead of up to 35% of the actual costs of relevant services or operating material. The causes are hidden in the systemic. First and foremost, there are delays in communication as well as inhomogeneous data or low-transparency processes. The effects thereof are noticeable for the customer through the price on the one hand and the lack of adequate performance on the other hand. Orders are therefore subject to considerable uncertainties in their realization<sup>1</sup>. The quality of business aviation suffers. A future, already designed as a fully autonomous system hardware requires a different general environment. It requires a setting without manual intervention and without delays in its operation. It requires the availability of an integrated, freely accessible and decentralized database and exchange layer for the complete representation of all relevant information and payment flows in the system<sup>2</sup>. In view of the overall digitization and automation efforts and the resulting, ever-increasing speed of implementation worldwide, organizations should strive to reduce their overhead in order to continue to persist on the market. For BizAv organizations, with reduced or completely eliminated overhead, there are opportunities to enter new markets and completely new customer segments. Many potential customers would not (yet) use a business jet or air taxi due to excessive prices, to date it is still a privilege. In order to resolve these fundamental problems, eliminate causes and make BizAv fit for the future, AVINOC was created.

The Aviation Network Operation Centers, which have been in existence since 2008, is an enterprise resource planning (ERP) software and business cloud application for BizAv, which has been further developed to this day. Inspired by the wide range of possibilities offered by Blockchain technology today, the development team decided in 2017 to transform existing knowledge from the ERP solution into a completely new system, the Aviation Network Operation Chain

AVINOC as a Blockchain solution provides a transparent, integrated, permissionless and decentralized base data layer for the exchange of relevant information for the GA. The main focus here is on BizAv. The aim of AVINOC is flight coordination, order management and infrastructural issues of the GA worldwide and, with the help of the integrated transaction and payment system, achieve-

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<sup>1</sup>Delays and cancellations of flights

<sup>2</sup>The system of BizAv includes all operators (aviation companies), crews (pilots, ground personnel, etc.), all infrastructure facilities (airports, authorities, dealers, fuel suppliers, manufacturers, etc.) and customers

ment of an optimal use of resources and a high level of cost reduction on the market. The primary goal is to strengthen the BizAv market with focus on reducing the time span of the information and payment flow to zero, thus creating an optimal supply chain. This will allow the entire global market to be strengthened and made sustainable for the future. It will furthermore result in positive effects on all other economic sectors of a country with well-defined BizAv. It will also enable future technologies, such as autonomous or semi-autonomous flying, to be effectively and efficiently deployed in organizations.

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# 1 General Aviation

General Aviation (GA) covers the worldwide civilian transport of passengers and goods, primarily aircraft and helicopters, outside scheduled (airlines) and charter flights. The GA is divided into business aviation (BizAv, or Business Aviation) and private aviation (private aviation). BizAv covers civil, non-scheduled, company-specific and intra-factory traffic and the commercial operation of business jets and helicopters for the purpose of transporting people and goods.

## 1.1 Characteristics

General aviation, and in particular commercial business aviation - in comparison to scheduled air traffic is characterized by the offer of non-scheduled, on demand air transport in the form of individual transports. The departure and arrival airports are not dependent on a fixed network for this point-to-point traffic. In addition to the availability of an operational aircraft including crew, the only limitations are in the range of the aircraft, the airport opening hours and their slots. The service is therefore largely unlimited in time and space. Typically, if not exclusively, considering the cargo area, smaller and lighter aircraft are used in business aviation than in scheduled and charter traffic. This also allows for a high individuality of the route network, due to their ability to fly to smaller airports with shorter runways near the actual destination.

## 1.2 Use

Based on these characteristics, and again in relation to the business aviation, the benefit is individual for each demander. The main focus is on the benefits through time saving. Time can be saved by using business aviation on demand as opposed to following a fixed time table on the one hand, and by the resulting possibility to reach multiple destinations directly and consecutively, on the other hand. The reduced ground transfer times between airports and departure and destination locations as well as shorter routes and faster check-in and security check-in times at airports are supported by use of special General Aviation Terminals (GAT). Another benefit is achieved by the high and reliable planning accuracy as well as the high degree of flexibility of the travel activities. The reliable execution of flights as well well-timed flights without delays are possible. In addition, business aviation is also used for the short-term and time-critical transport of sensitive, critical or oversized goods or equipment. In the area of humanitarian activities, business aviation can bring benefit in the form of health and vital blood or organ transports, and for the transport of relief goods. The execution of evacuations in case of special emergencies is another field of application of the GA due to its simple and quick availability.

## 1.3 Economic importance

In addition to individual benefits, the GA and BizAv make an important contribution to the economic performance on all continents. This can be measured by gross value as the difference between

production value and intermediate inputs.

The economic impact of the sector is represented by a direct, indirect and induced value. Direct added value is attributable to direct production, operation or maintenance of business travel and private aircraft. The use of products and services by manufacturers, suppliers and maintenance companies in other companies represent the indirect value along the value chain. The induced economic impact includes the financial resources spent by directly or indirectly employed employees outside the general aviation industry.

Business aviation can generate a great deal of value for large companies that are increasingly relying on the use of this service option to better manage their operational business. Business aviation has a demonstrably positive impact on earning power and thus on the value of the companies involved in it. (Advisors, 2017)

## 2 Market

The total annual revenues of commercial aviation (scheduled, charter and general aviation) in 2017 reached a value of around USD 1.1 trillion. The share of General Aviation amounts to approximately 26% or USD 286 billion. (Aircraft, 2015; BLD, 2018; Fly, 2013; Galovic, Inkret, u. Winter, 2018; GAMA, 2017)

Currently, around 350,000 aircraft are operated worldwide. Of these, around 93% or 325,000 aircraft are used by General Aviation. Of these, 61,000, which is 17% of all aircraft worldwide for business aviation and about 76% or 266,000 aircraft worldwide for the rest of general aviation (private aviation and others). Only around 7% or 25,000 aircraft cover the scheduled and charter segment. (Aircraft, 2015; BLD, 2018; Fly, 2013; GAMA, 2017)

Figure 1: Total market of aviation



Global revenue growth in commercial aviation between 2003 and 2017 on average amounts to around 10% per year, well above the average in Asia. (Statista, 2018b)

### 2.1 Operator models and usage concepts

For General Aviation, and in particular for BizAv, there are basically four different demand-based access options for market participants. The most important determinants for choosing the appro-

appropriate model for business aviation flights are, in addition to budget constraints and the expected intensity of use, i.e. the flight requirement in hours, the distances to be covered, the availability of the aircraft, the availability of the crew and the average number of passengers per flight.vgl. [ Peter, 2004, S.15][ Sterzenbach, Conrady, u. Fichert, 2009, S.260][ Lang, Ziegler, u. Linz, 2012a, S.47]

### **2.1.1 Full Ownership**

Full ownership refers to the complete acquisition and independent operation - possibly by employing a service provider - of a business aircraft. As a rule, these external service providers are charter companies that also provide so-called aircraft management services.

### **2.1.2 Fractional Ownership**

This operator model is characterized by the acquisition of a business aircraft by several investors. In this case, the investment costs are proportionately paid by one-off payments and thus part-ownership is obtained. In addition to the acquisition costs, there are monthly fixed costs for the operator as well as variable costs for the actual air traffic.

### **2.1.3 Charter / Air Taxi**

Charter as the operator model is the simplest and most widely used model. Charter flights are booked either directly with the operator or through a broker. The entire business aircraft including the crew is chartered and usually billed to-the-minute, charging only the pure time of use. It is still possible to differentiate between on-demand (or ad hoc) and contract (or block) chartering.

The Air Taxi as a new charter concept differs in that it provides the possibility of booking individual seats as opposed to the entire aircraft. Preconditions for this are small and cheap airplanes as well as corresponding information availabilities.

### **2.1.4 Jet Membership / Jet Card**

With this operator model, a customer buys a defined quota of flight hours within a specified period of time. Only the costs for the flight hours purchased are paid. If not consumed, the unused hours expire.

## **2.2 Structure of Offers**

The term providers in General Aviation refers mainly to operators of business aircraft. The provider structure is very fragmented. The majority of providers (operators) are assigned to the area of micro (1 aircraft) and small suppliers (2 to 4 aircraft in the fleet). There are around 2500 registered operators in the US, some 700 in the EU and an estimated 3800 in the rest of the world. Thus, there are around 7,000 business aviation operators worldwide.



## **2.3 Structure of Demand**

### **2.3.1 Customers of the BizAv**

In the context of General Aviation, the term "customers" is used almost exclusively in Business Aviation of The demand side can be segmented into companies (large companies, medium-sized enterprises), wealthy individuals, agencies (tourism / events / adventure / sports) and the government or authorities. The customer's contract services include following objects to be transported:

- Individuals (VIP-Service)
- Priority goods and special cargo transports and in-house transports (with, for example, Antonov An-225/224, Boeing 747 or Super Guppy and Beluga)
- Supply for remote and hard-to-reach regions - worldwide, e.g. Tundra (Russia), deserts (Australia / Africa), mountains (Alps, Himalaya region). In places, this is even the only supply option.
- Air Ambulance and Flying Doctors (Australia / Africa / Amazon)
- Corporate clients for business / workforces
- urgent goods (production, health)
- dangerous and sensitive goods (radioactive material, samples, etc.)
- Emergency aid (UN, rescue services, evacuations)
- Surveillance and exploration, surveying, aerial photographs, other surveys (science, authorities)

### **2.3.2 Customer requirements for the product**

Customer requirements, along with the expected benefits of business aviation, are focused primarily on quality, comfort and flexibility (such as simultaneous cargo and passenger flights ). These expectations may relate to requirements placed on the hardware, ie the aircraft, the conditions on board and the service on the ground.[vgl. G, 2008, S.13] The expectations can be summarized as follows:

- Hardware (aircraft, prestige / brand, performance and performance parameters and purpose)
- Conditions on board (equipment, exclusivity, comfort, hybrid use - variable seating)
- Service (catering, concierge service, ... with a high quality of service and integrity)
- Conditions on the ground (transfer, handling, reception, door-to-door times and methodology at check-in / out)

### 2.3.3 Demand Behavior

In terms of area, business aviation needs are basically largely scattered, with concentrations on specific axes between centers of economic importance being identifiable. In terms of time, there are seasonal differences with a strong phase starting in March until November and a weak phase between December and February. Within one week, the weekend (Saturday and Sunday) are less frequently used than the rest of the week, with most flights being recorded from Wednesday to Friday.[ Lang, Ziegler, Linz, u. Braun, 2012b, S.72]

- Seasonality (mainly summer and winter tourism)
- Weekly pattern (Business Meetings)
- Events (large and special events, GP, Airshows, fairs)
- Particular events (disasters, rescues and evacuations, material requirements to maintain productivity)

Trends in demand behavior can be seen in the wake of increasing sales of aircraft manufacturers. In general, demand for business jets is expected to pick up, driven by increased customer demand. Honeywell, in its latest market survey, expects sales of 9450 new aircraft to be delivered between 2014 and 2024. Light jets play an important role in the air taxi business, as they allow the entry into business aviation. It is therefore important for a number of manufacturers to be able to offer their customers a family of business jets that offer opportunities for advancement from small to medium to large. The group of entry-level jets and super light jets includes, for example, the Learjet 75 and the Citation XLS +. Lightjets refers to models that have a range between 1100 NM and 2000 NM (with four passengers), cost between 4.6 and 12 million \$ and have a cabin volume of up to about 12 m<sup>3</sup>. [Aerokurier, 2015] Due to manufacturer demand and according to the requested samples, the following can be found for customer demand behavior: The trend shows the growing influence of the taxi range in the industry. Customers increasingly ask for short but also cheap flights. These are possible according to the calculations only with corresponding cheaper aircraft. Here, the trend also clearly shows that around 4 passenger seats are sufficient to serve a small circle of friends, small workforces or families. The speed of transfer and the ability to stay among themselves play an important role in this context

## 2.4 Industry Structure Analysis

With the help of the Five-Forces-Model ("Five Forces") according to Porter [ E., 2008, S.79-93], the competitive intensity of an industry can be determined based on the individual characteristics of the so-called Five Forces. These are largely responsible for the profitability and attractiveness of the respective industry.

### **2.4.1 Rivalry among existing competitors**

The current competitive rivalry is considered as strong to very strong in all segments of Business Aviation. Above all, information about customers is an important parameter. These trade secrets<sup>3</sup> are particularly protected and are crucial to the success and failure of aviation operations.

### **2.4.2 Threat of new competitors**

The threat of new competitors, however, is seen as rather low because of the high market entrance barriers in the industry. This is in particular due to the high capital requirement and the associated high risk. In addition, the staff is confronted with high entry barriers, because, regardless of rather easily obtainable and reasonably priced pilot licenses, the ratings<sup>4</sup> for the respective aircraft types are quite expensive compared to the license. For each aircraft type, the corresponding rating must be renewed at periodic intervals (usually once a year for professional pilots).

### **2.4.3 Threat of substitutes**

Possible substitutes for the sector could be scheduled flights or charter flights, road or rail transport and video conferencing. The position of the substitutes is subject to the respective infrastructure as well as the general economic situation. Videoconferencing is only used in special situations and will not pose a threat in the future. In business, videoconferencing is often given as an answer to reduced travel budgets, but experience of recent years has shown that this behavior only increases in exceptional situations<sup>5</sup>. Face-to-face contact is preferred by the majority of market participants using BizAv, unless there are significant financial issues.

### **2.4.4 Negotiating power of the customers**

The negotiating power of customers is (still) severely limited as there is great lack of transparency in terms of prices, availability, infrastructure and information concerning the aircraft itself. The need for intermediaries (brokers, broker platforms) only adds to the problem.

### **2.4.5 Bargaining power of the suppliers**

Relevant suppliers include aircraft manufacturers and service partners. These include, in addition to the Fixed Base Operators (FBO), oil companies, caterers, Air Traffic Control (ATC), providers of flight planning services and so-called Maintenance, Repair and Overhaul companies (MRO). Among aircraft suppliers, there is currently strong competition due to an oversupply of aircraft. The service providers are in a strong negotiating position due to the current structure of General Aviation and especially Business Aviation.

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<sup>3</sup>On this view, one can speak of a generally valid view for all markets.

<sup>4</sup>Ratings are special theoretical and practical trainings and subsequent exam specific to one type of aircraft that will entitle the pilot to fly this type of aircraft.

<sup>5</sup>e.g. Reduction of business flights from 2008-2010 due to the impact of the global economy

## 2.5 Operator / Broker / Broker platforms

### 2.5.1 Operator

An operator associated with BizAv operates one or more aircraft<sup>6</sup> for the Business Aviation. An operator is either only operator of the aircraft (Operator) or owner and operator (Operator & Owner). An operator requires appropriate state licenses that entitle him to operate business aircraft. The licenses must be renewed periodically. The operator also ensures that all companies associated with the organization, and in particular the personnel<sup>7</sup>, have the appropriate qualifications and keep them up-to-date. The operator is responsible for flight operations, responsibility is assigned to crew or ground crew for the respective mission according to the qualifications of the persons deployed.

### 2.5.2 Broker

Brokers does not operate their own aircraft. A broker acts purely as intermediary between the potential customer and the operator and without responsibility concerning the aviation aspect. He selects the fitting aircraft from the operator for the customer, based on the latter 's requirements. For this action, a mediation commission has to be paid. The flight itself is settled with the operator, whereby it is not uncommon to buy quotas if they are offered. In principle, no specific business license is required to practice as a broker in BizAv.

### 2.5.3 Business Aviation Broker Platforms

Broker platforms have emerged in recent years<sup>8</sup>. These are accessible via Internet to a restricted user group (operators, holders and brokers as well as agencies). In principle, these platforms assume the role of an (additional) broker and are, however, primarily used by brokers or operators, and not by customers, because of the high usage costs. A direct, electronic booking of flights is not possible via these portals today, they only offer contact information or request forms.

## 3 Issues

An inspection of the macro environment of the GA sector and in particular the BizAv, shows framework conditions that affect the industry and in particular the supply and demand structure. These include the economic, technological, ecological, political-legal and socio-cultural environment.

An analysis of current problem areas of the business sector, however, focuses on the examination of the microcosm of GA and BizAv, adding structure field and the internal structure of the sector to the logic of macro-influential factors.

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<sup>6</sup>summarized also referred to as aircraft fleet or fleet only

<sup>7</sup>Crews consisting of pilots and stewards as well as ground personnel and government-mandated line managers as well as responsible persons

<sup>8</sup>eg avinode, returnjet, ainonline

The fields we have identified for the "functioning" of the sector in terms of AVINOC, or current problem areas, are information and communication management as well as the rapidly increasing technologization.

### **3.1 Information and communication management**

In the context of our solution, information and communication management means the generation, procurement, provision and use of all relevant information in the relevant, temporal context, which ensures the "functioning" of the business sector in the sense of optimal planning and execution of the respective tasks as well as the implementation of suitable information and communication structures.

### **3.2 Technologization**

Technologization as we understand it is the degree of automation and digitization of the information and communication resources already used by market participants, as well as the degree of digitization of the entire sector in terms of the use of already available but not yet realized possibilities of technology, digitization and automation.

### **3.3 Current characteristics**

Within the identified problem areas of GA or BizAv, there are currently a number of different forms of issues, which are illustrated by the following examples:

#### **3.3.1 Empty Flights**

Empty flights (empty legs) in the BizAv are flights without passengers to a destination to pick up passengers or away from a destination after passengers have been dropped off. Empty flights primarily mean a sub-optimal use of available resources and thereby cause low utilization of the aircraft at a higher cost. The main reason for this is the lack of availability of consistent, up-to-date and reliable information on flight capacities, fuel, crews and infrastructure. Although the balancing and offering of such empty capacities is handled by platforms, they are often not connected and therefore operate as islands.

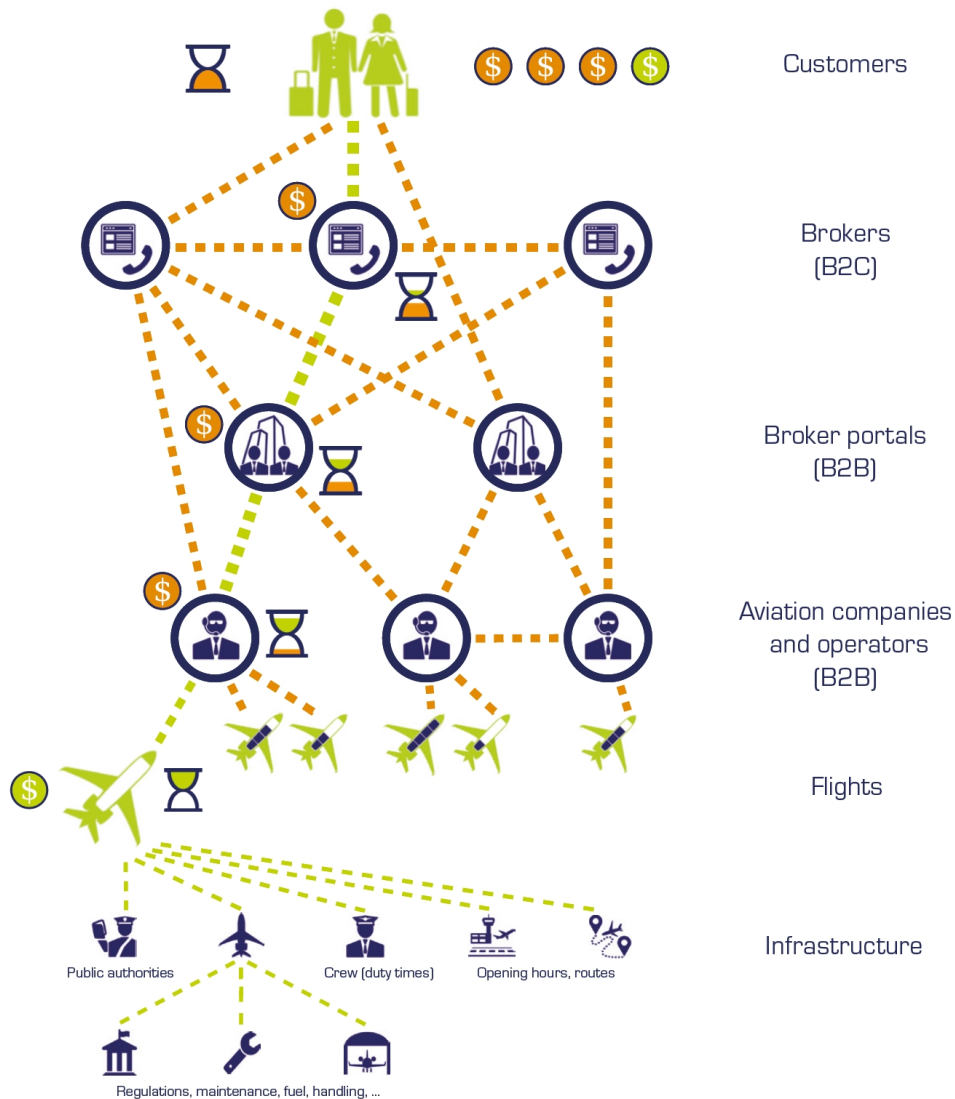
Figure 2: Scheme of classic empty flights (empty legs, depicted in orange)



### 3.3.2 Intermediaries

The term "intermediaries" in the existing context means mainly the brokers and broker platforms. Brokers and broker platforms are required to establish the link between customers and operators on the one hand, and to conduct business on behalf of clients and operators on the other hand. The work of brokers is characterized by a lack of data availability, inconsistent and sometimes outdated data, low data reliability and a high degree of flexibility using many different systems. This causes a high manual coordination effort by e-mail, telephone and fax as well as complicated communication structures resulting in large amounts of time spent and high system costs.

Figure 3: Scheme of structure today with intermediaries (brokers, platforms)



### 3.3.3 Inhomogeneity of the systems and increasing complexity

The information [data] required for optimal functioning is basically existent in the overall system (GA and BizAv - macro and micro environment) and is used in individual areas in the form of isolated solutions. However, a large number of different systems with sometimes considerable differences in the technologies used are used in the overall system, and their system compatibilities and data homogeneity are very low. In addition, in all macro environments affecting the industry, speed and pressure increase, which in turn increases the complexity of the overall system. Effects of this are e.g. the high operational time required for all system participants due to difficult communication and cooperation, high system costs, increased risk and a high degree of error proneness. This complicates cooperation and communication with business partners and customers and also interferes with internal business processes<sup>9</sup>.

<sup>9</sup>Internal processes, if any, must always be adjusted or "broken up" to respond to complex situations. Employees, for example, are permanently prevented from doing their actual work by coordination or telephone calls. A flow in the

## 4 Future challenges

BizAv's future demands on the market, in addition to solving the challenges of technological and geopolitical change, are to continuously optimize and subsequently automate processes. This is also required to accommodate future technologies that are currently in the developmental or even pre-delivery stage, e.g. to integrate autonomous aircraft or semi-autonomous classic aircraft into the organization. New technologies typically have a high level of readiness for automation and are designed for autonomous operation. Organizations are therefore anxious to adapt their structures to the increasing automation. This includes the automation of the functional or technical operation of organizations operating in BizAv or its environment<sup>10</sup>.

In order to safeguard BizAv's growth and viability in the future, it will not only be necessary to optimize existing processes, but also to develop and win new markets or customer segments. The taxi and cargo areas represent the segments with the greatest potential, as the claim to exclusivity on board does not necessarily have to be higher than in scheduled or charter aircraft. Optimizing the empty-flight problem globally would mean no losses for an individual company. Rather, the resulting cost reduction would mean a win-win situation for the customer and the operator. The effect would also have a positive effect between neighboring BizAv companies, since cooperation would be possible based on an enabler: Here, a cost reduction of up to 39% (see 3.3.1 on page 13), based on the number of global empty flights, and in individual cases even of 66% or more. Price reductions allow for the additional acquisition of new customer segments, without having to make fundamental changes in the operation<sup>11</sup>. Aircraft manufacturers would be able to bring new, simpler patterns to the market - current trends are already pointing this way, in view of the growing market for micro jets optimized for taxi flights.

As market growth increases, so does the degree of complexity implicit in the market. New solutions require more resources, especially when new technologies or systems are used. It will be necessary to maintain and expand the existing flexibility of GA or BizAv (see 1.2 on page 6) in order to make the actual system purpose of BizAv sustainable. This flexibility requires much faster processes in the future, which no longer require manual intervention. This not only applies to the actual operative business, but also to the reporting in the strategic area as well as in the acquisition of information and interaction with all stakeholders in the scope (infrastructure).

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sense of an optimized process does not happen.

<sup>10</sup>AVINOCs survey on aerospace found that there is a need of a high degree of digitization in BizAv. This was confirmed by information from audits of the Research Funding Society (FFG) and the Federal Office of Civil Aviation (BAZ) in Austria. Digitization is a basic requirement to make automation possible. The corresponding system status in BizAv has hardly changed to this day. However, the complexity in the aviation business sector increased and digitization could not follow in this field. Third-party platforms produced a network of inhomogeneous islands. It must be remembered that the lack of digitization can also be seen as an opportunity. That step, often associated with additional expense of digitization, could be skipped and united under the aspect of automation. Such a declined process could for example be observed when introducing the cash register obligation in Croatia. Previously, electronic cash registers in the hospitality industry were only available to a very limited extent; digitization was not present. After that, almost everywhere a mobile app solution was used that met all requirements and at the same time the processes were optimized and some automated. At that time, the development of mobile networks and new opportunities in app development were regarded as enablers.

<sup>11</sup>Apart from changed marketing activities or the on-board service



The infrastructure already provides certain approaches (information services at airports, portals, systems of fuel suppliers, engine monitoring using Blockchain from R&R, NMOC). However, there are still major challenges, such as the integration of existing communication interfaces or the simple integration of existing solutions in a single communication infrastructure or base data layer. The communication infrastructure requires a high degree of flexibility while reducing complexity and has to cope with future challenges. Modular, simple, extensible and yet integrate-able designs according to a defined standard offer a possibility to realize this. Without compromise, the future system must ensure a high degree of security and stability in global deployment, and it must not exclude participants.

## 5 Vision and Mission

### 5.1 History

AVINOC, in the form of the "Aviation Network Operation Center", was developed in 2008 as an ERP cloud platform to optimize processes to a high degree and strengthen the business operation of the companies within BizAv. Its design and integrated data structure allows it to fully cover all the business processes of a BizAv company and fully integrates suppliers<sup>12</sup>. From acquisition, through the tendering to accounting and accounting modules, all financial aspects of the operational business can be covered. The system makes it possible to make an offer to the end customer immediately, since all (planning) data and system statuses are always up to date. In addition, the complete technical operation was depicted and fully integrated in the design and connected with the financial area. The technical area includes crew and qualification management, flight planning with company flight plans and route calculation, various maps, all necessary government-defined records and all necessary data for reporting all activities of the company<sup>13</sup>. Furthermore, already with the emergence of AVINOC, the idea was born to make available empty flights internally or via APIs platforms or third-party websites. This is done on a voluntary basis by each licensee of AVINOC. Only feasible flights are offered (spam protection, quality and customer satisfaction). Licensees can access a defined set of flight data from pilots of other companies. On the one hand, this represents an official obligation and, on the other hand, it made it possible to plan flights better on the basis of the available duty times. Information on fuel suppliers and their availability, weather information, handling and airport GATs and fees can also be shared on-demand with other organizations in the system. AVINOC, in the form of the Aviation Network Operation Center, operates as a cloud solution and has enabled airlines to streamline their operations for more than 9 years while reducing the administrative burden and associated costs.

With the emergence of Blockchain as an enabler and the strengthening of Blockchain in public perception, as well as far-reaching improvements and elimination of teething problems, AVINOC's

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<sup>12</sup>Dispatch companies, free pilot logbooks, maintenance-and-repair, etc.

<sup>13</sup>Engine and aircraft telemetry information, Flight and Tech-logs, Logbooks, Duty-Times (these are recordings of crews duty and working hours and are an essential aspect of aviation safety).

transformation process - from the Aviation Network Operation "Center" to the Aviation Network Operation "Chain" began. The focus was on transforming existing concepts of the underlying architecture into a Blockchain solution under the premise of a substantial simplification and the added value of an integrated payment system, while at the same time improving security and stability through the implicit mechanisms of cryptography.

## 5.2 Vision

Our vision of AVINOC is to create a unified, permissionless data base layer with an integrated payment system for general aviation and in particular for BizAv to make sustainable development possible. In doing so, we place particular emphasis on optimizing processes by fully automatizing them to reduce communication flow times to near zero and, at the same time, allow payment for services at the same speed. The means of our choice here is the Blockchain, which we specifically upgrade for the purpose. We believe in BizAv as a motor for innovation and progress, and we believe in particular that it will have far more potential in the future than may currently be imaginable in many places. For us, AVINOC means a genuine and honest disruption<sup>14</sup> in order to lay the foundation for the future of BizAv and, as a result, enable autonomous flying for operational businesses on a global basis<sup>15</sup>.

## 5.3 Objectives and mission

To make our vision a reality, we will start by transforming BizAv's existing processes and make them less complex and less time-consuming. In the first instance, we address communication and issues that currently lead to high financial overhead and include the key challenges of the BizAv renewal process. Here, we focus on the two problem areas represented by intermediaries (brokers) and empty flights. In the course of our further activity, we will try to reconcile processes with infrastructure and all stakeholders involved and (re-) define suitable interfaces. In demand management (or operational research) and in later development, we view all problem areas from the perspective of systems science with the help of System Dynamics<sup>16</sup>. We see ourselves as a project designed through and through for an open-source community and at the same time implementing all principles and methods of project and quality management in order to comply with aviation safety and to make it sustainable. We would like to share our knowledge with the world as soon as we have been able to lay the foundation with AVINOC as a Blockchain solution and have everyone actively participate in it. For this purpose, we have also scheduled appropriate resources to spread AVINOC in the

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<sup>14</sup>In the context, we understand the term "disruption" to always be positive in the sense of completely innovative renewal.

<sup>15</sup>Technical or traffic communication, e.g. Vehicle-to-Infrastructure (V2I) or Vehicle-to-Vehicle (V2V), in the course of aviation movements and coordination (e.g., collision avoidance, separation, etc.), is not currently AVINOC's goal

<sup>16</sup>„System dynamics is a method of dealing with questions about the dynamic tendencies of complex systems, that is, the behavioral patterns they generate over time“ (D.M., 1980)

world<sup>17</sup>. Using existing resources, we will create and operate the initial infrastructure necessary for AVINOC and, as part of the project, we will expand it with strategic partners and authorities - and let everyone participate in it. With AVINOC we will deliver a significant contribution to the future of general business aviation, the BizAv.

## 5.4 Change

AVINOC is aware, or we are aware, that a "disruption of general business aviation" can not happen overnight. People always need time to adapt to changes in the environment. This is especially true for complex markets and their stakeholders. Nor can new markets be developed instantaneously, especially when it comes to changes in complex, situated structures, just as aviation. The process must therefore be gradual, dynamic, voluntary and barrier-free. Additional efforts needed from the involved companies and especially from the customer are to be avoided. We appreciate all these aspects and consider analysis and change management to be valuable tools in our project. Our experience as well as mistakes from the past enable us to preserve the "big picture", to gradually rebuild or expand on it and, if necessary, to completely redesign it.

## 6 Solution

In particular, we would like to point out to readers of this white paper that this is not a technical implementation guide. We discuss technical solutions insofar as the explanation requires. The solution described below is AVINOC as the Aviation Network Operation "Chain". In accordance with the defined problem areas and causal relationships, we focus our attention on eliminating these in our solution and ultimately provide the appropriate conditions for the system.

### 6.1 Root cause analysis

The following influencing factors can be recorded in the system model as causes for the occurrence of intermediaries and empty flights:

**Communication** time is required in all information acquisition processes. It increases with the degree of complexity and the number of stakeholders involved in carrying out a flight. Manual intervention, tuning or required approval of process steps increases the communication time and consequently the entire process time. Likewise, manual decisions may cause process crashes.

**Transparency** is currently virtually non-existent in BizAv, as all companies fear losing customers to competitors. This leads to secrecy and the companies isolating themselves. The

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<sup>17</sup>See also "How to Use and Distribute" the Token for Future Developments, Marketing, and Strategic Partnerships at <https://www.avinoc.com>

resulting low level of transparency leads to intensifying control loops (causal loops, from the CLD) in which additional, time-consuming efforts can be identified as the main cause.

**Process** time (in general) is an additional factor which increases the overall time for planning a flight together with communication time, with each additional loop (pass).

**Process** accesses are only digitized in places. In some places there are interfaces (NMOC<sup>18</sup>), but these are inadequately interconnected, or not at all or their design is very provider-specific. Integration requires additional adaptation efforts and updating on the supplier side and is rarely exists for individual solutions.

**Standards** , there are many standard in aviation, but there are none for the coordination of BizAv flights and planning, nor for procurement. All providers have their own structure within each isolated solution (platform or app). Even large authority complexes, such as those of FAA and EASA are inadequately compatible with each other in their systems. There is no uniform protocol for the exchange of planning information.

## 6.2 Application and requirements

Aircraft can only be operated efficiently if the administrative and organizational environment provides suitable conditions. There should be no manual entries within the defined process flow (from offer to payment), which could not already be replaced by automatisms today. Redundancies and the manual or semiautomatic transfer or synchronization of data demand unacceptable additional time and effort. All time spent in the system model increasing the systemic effort must be restricted in their effect or completely canceled out. Full digitization with inherent automation already implicit in the design allows

- to meet future challenges in BizAv,
- to remedy failures of the past in this context,
- to create worldwide free access and
- sustainable operation with all its implications, such as to effect the required cost reduction.

For a model to produce integer data it must be based on consistent standards at information and communication layer level. These define the structure and, in its technical realization as a base layer including all necessary interfaces, allows the exchange of all relevant information for the coordination of flights and infrastructure information of the BizAv. The model is permissionless, self-regulating and ensures the creation of integer data. The introduction of non-relevant information or information that offers an advantage only to one market participant, are avoided by design, in accordance with game-theoretical considerations and economic public interest. It will use a

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<sup>18</sup>Network Manager Operations Centre (NMOC, previously also CFMU) of Eurocontrol

technology that meets these requirements. Only Blockchain technology offers the suitable solution. To cope with all eventualities, the classic Blockchain model only needs to be adapted to include point-to-point privacy. The payment system, implicitly integrated into the Blockchain by design, is an essential asset<sup>19</sup>. As a result, the information flow and the financial flow are equally fast, with the process speed in the system thus heading for its theoretical optimum.

## 6.3 Privacy-Classes

Since aviation business comprises organizations in competition to one another (see 2.1), fundamental questions about the architecture of the system need to be asked. An expanded, decentralized and permissionless Blockchain can solve the apparent contradiction of transparency and desired privacy.

### 6.3.1 Which data are readable for all market participants?

What is required to align the organization with the rest of the market? Which kind of coordination does the market require? What is allowed to be transparent by definition? This is the kind of information that should be made available directly or indirectly (for example via brokers or portals), such as information on flights, deploy-able crews (if they are self-employed or leased personnel), information about the infrastructure (airports, handling, opening hours), NOTAMs<sup>20</sup>, etc. This information must always be available anywhere. Solving the empty flight problem, for example, is directly related to unrestricted access to data of this kind.

### 6.3.2 What must be visible to market participants?

From an aviation point of view, this is information that guarantees the safety of aviation. These data need not be public in nature, but every legitimate stakeholder in the system must have access to it. These are data that are required to be recorded by the authorities and companies must submit them on request or at periodic intervals. For example, pilot logs must be known to every company in which the crew member has or is planning to perform duty (Duty-Times regulations). Third parties, as organizations (with the exception of authorities) who have never worked together with the crews, do not need this information. The same applies to airplanes changing operator; here the entire data must be made available. Nevertheless, protection of this information is still a primary concern, since - in accordance with recent developments such as the implementation of the GDPR<sup>21</sup>, these would be considered personal data.

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<sup>19</sup>This is a puristic consideration considering the original purpose.

<sup>20</sup>Notice (s) to Airmen, are orders and information on temporary or permanent changes to the Aeronautical Information Publication (AIP)

<sup>21</sup>General Data Protection Regulation (GDPR), is a regulation of the European Union for the protection of personal data, trends there are worldwide.

### **6.3.3 Which data are only readable for business partners?**

The essential issue is: Which trade secrets have to be kept and what are they? An identifiable customer or an agreement with a supplier can be understood as data of this kind. This applies to most contract contents in this context, with the exception of general information for finding the contracting parties, official price lists or general, publicly available information.

### **6.3.4 General requirements**

Thus, following general requirements can be deduced:

- Data must be integer, homogeneous and transparent according to the definitions of the standard
- Data that are to be completely protected or visible only to a subset of stakeholders, have no place in the Blockchain
- Data must be processed in real time to prevent delays in intensifying systemic loops
- The system must be decentralized and permissionless so as not to present an entry barrier
- In order to be accepted in the market, the technical barrier for the implementation in 3rd party applications is to be kept low
- Regulations and laws must be given special consideration in aviation

## **6.4 Approaches**

The answers to the above questions have shown that a Blockchain solution can meet all requirements. Aviation requires high transaction speed to meet the demands of ad-hoc information flow. The system must therefore be specially adapted with additional components. The Blockchain is mainly responsible for the handling of general, public data and serves - in addition to the classic payment system - as a parameterize-able trigger system for advanced smart contracts. It is not possible to map all the relevant options and links apart from normal operation, which occur in aviation on a daily basis, in classic smart contracts. Already in the handling of simple flights, classic smart contracts would not work efficiently in case of an extraordinary event, and might fail in more serious or exceptional events. Solving the resulting problems, such as reversed transactions, cancellations, etc., additional system energy would be required.

Again and again, extraordinary events occur in aviation (such as route deviations due to weather events or geopolitical and geographical circumstances), and complex and - from a global viewpoint, - non-uniform judiciary prevails. To illustrate this, a simple flight and its payment could be handled by smart contract. If everything works smoothly, the debt could simply be settled (flight operations). However, as soon as an occurrence prevent the debtor from paying off the debt, all situational distinctions in case-law would inevitably have to be made in accordance with prevailing law,

transnationally and, in particular, aviation transport guidelines. These are complex, non-uniform and sometimes contradictory regulations<sup>22</sup> that would produce a highly complex and extremely error-prone contract on the one hand and, on the other hand, could not be reproduced by code because of contradictions that occur in places. A smart contract with a fault<sup>23</sup> is therefore to be rejected for safety and efficiency reasons in aviation. The additional time and effort needed to eliminate errors in smart contracts is in contradiction to the basic idea of optimization. AVINOC therefore integrates in its Blockchain a generic Point2Point Smart Contract (P2PSC, see 6.4.2 on page 25) business relationship management system, enabling advanced smart contracts based on traditional contracts and fully compliant with jurisprudence.

#### 6.4.1 Blockchain

The Blockchain in AVINOC allows the exchange of all relevant information which (according to 6.3.1 on page 21 or 6.3.2 on page 21) must be available in principle. This includes all information on flights, such as the aircraft identifier or pattern (type of aircraft), departure and arrival times (in UTC), and information about the respective airport (ICAO<sup>24</sup>-Code). In addition, if desired by the operator, the freely available capacity<sup>25</sup> is indicated and stored as a parameter in the transaction. This information comes from AVINOC's integrated slot management and allows simple status queries based on a simple traffic light scheme (red, yellow, green). Subsequently, the status queries are also necessary for effecting a flight booking. All information is available in the status tree. They contain all related resources and their further availabilities in underlying branches<sup>26</sup>. This way, AVINOC implicitly ensures an ad-hoc information flow. The user (operator, customer, supplier) recognizes which elements are missing for a flight. Third parties can adapt to it and ad-hoc adjust their projects, such as flights or sub-projects, such as crew deployment, fuel deliveries, etc. to new or changed statuses. Customers of passenger or cargo flights can thus keep the status of their business plans up-to-date. In the event of cancellations, it can be used to immediately book a new slot based on further availabilities. In the future, AIs will also play a major role in predicting the development of status in time series and on the basis of the basic possibility of the analyzable behavior of the system or of all individual market participants<sup>27</sup>. All relevant information that makes a flight possible in the first place and has impact on its planning, is thus coordinated by design within the Blockchain and changes according to the required standard in mutual dependence. This allows for the emergence of a living "aviation organism" that knows its "system status" at all times and can respond dynamically to changing situations.

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<sup>22</sup>For example, there are openly known inconsistencies in the EASA's duty-time regulations regarding time-of-flight definitions between local time and UTC.

<sup>23</sup>Its occurrence is highly probable according to common error theories when increasing complexity.

<sup>24</sup>ICAO - International Civil Aviation Organization)

<sup>25</sup>Seats and cargo, in volume or weight

<sup>26</sup>For example, the flight depends on the availability of the aircraft, which in turn depends on the fuel to be purchased at a particular location at a particular time, etc.

<sup>27</sup>The development of AI-driven systems for predictions is not, for the time being, part of the development of AVINOC.

**6.4.1.1 Introduction and initialization** For a flight to take place, an aircraft is required<sup>28</sup>. The aircraft must therefore be initialized once in the Blockchain to form the basis for flights. For the initialization of the aircraft, in the sense of a "high value asset" in the Blockchain, the transaction costs will be higher than, for example, for crews or individual, relevant persons in operational function. Depending on the economic performance parameters of each class of objects (aircraft, pilots, stewards, operations managers, suppliers, etc.) that are brought into the AVINOC Blockchain, corresponding to functional units of a supply chain model, as container, there are more or less high transaction costs. Thus, upon entry into the system, a corresponding protection against participants or actions unwanted on the market is already granted by the game-theoretical approach implicit in the Blockchain<sup>29</sup>.

Mind you, the Blockchain is and remains self-regulating in this approach. Once objects have been introduced in the Blockchain (containers), they can then simply be passed around, for example, the aircraft between different operators. They always use the same, real object and represent it virtually. Another positive side effect is, for example, that the change of identifiers due to a change of ownership (change of owner) always remains completely traceable. The aircraft, as a virtual container, always remains the same. The information from the container follows the principles of a perfect log, as a Blockchain is in general. The same applies to pilots and other objects virtualized in the Blockchain and, subsequently, to all flights that have been finalized. Thus, the system meets the requirements of the authorities and additionally increases the safety of aviation. Economically, the respective organization has full cost control and cost transparency - globally, on an integer and homogeneous database.

**6.4.1.2 Business operations** In daily flight scheduling operations, each entry in the block chain is tagged as a transaction with variable transaction costs. AVINOC's underlying design strives to make the transaction costs of all flight components self-financing, demanding only a very small part of the savings from the elimination of intermediaries and all related costs. For a full-availability ("green") status, flights in AVINOC will require a ready-to-operate aircraft and ready-for-action crews in accordance with aviation regulations (e.g., two-person cockpit operation for passenger transportation on commercial flights). Availability of crews and aircraft implies, on the one hand, the physical availability at a specific location at a given time and, on the other hand, the existence of necessary qualifications and recurring checks and exams that have been passed<sup>30</sup>. Once available flights are put into the Blockchain, gaps resulting from the empty leg problem, can be closed by all market participants. The planning information available in the Blockchain is immediately known to all market participants. Other operators, crews, or platform providers can identify all empty-legs or flights tagged for jet-sharing based on the location and time information available globally and instantly in the Blockchain. Changes are also identifiable and immediately be compensated by replacement

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<sup>28</sup>Airplane, helicopters, drones and airships

<sup>29</sup>The introduction of, for example, many aircraft requires only one-time, but in total high costs. If these costs are far higher than the (reprehensible) purpose, which also can not target a single market participant, then abuse will not find a breeding ground (because too expensive).

<sup>30</sup>In the aviation context, it is also referred to as qualification management or aircraft checks.



flights.

It is possible to react to large-scale and extraordinary events<sup>31</sup> immediately and scheduling can be adapted accordingly. Advanced infrastructure information preserves full predictability. The focus here is not on the cause for the changes, but on immediate global communication of the change. In accordance with to existing agreements made via P2PSC, default reactions for exceptional cases can also be defined. If companies in AVINOC are not yet in a contractual relationship with each other, the P2PSC model integrated in AVINOC allows the connection via flight information. Thus, AVINOC creates a BizAv market network that is individually tailored to specific needs and preferences.

**6.4.1.3 The flight customer** We talk about "empowering" the customer and we mean it that way. A closer look reveals that all information underlying the Blockchain provides the basis for a direct booking platform - even for end users. They only need to be made available to the market through apps or platforms<sup>32</sup>. The customer is able to instantaneously identify and book his relevant flights - based on planning information. He represents, as well as the original broker, a client, whose order has to be fulfilled by the operator. For the protection of the customers, be they individual customers only booking a single seat or business men booking the complete aircraft, a penalty system is integrated in the Blockchain. This system can be customized by all participants in the market, whereby AVINOC can provide an offset in the design. Cancellation conditions are defined by the P2PSC system and come into effect under specific circumstances previously defined between the contractual partners. Payment is made immediately and directly in the Blockchain according to the terms of the contract. For example, the cancellation of a flight by the operator allows immediate compensation payment (possible set by authorities) or individual amounts of penalties. The time factor plays an essential role here. Until shortly before the flight, a substitute flight can immediately be found from another provider (operator), also due to the extensive database in the Blockchain and its transparency. This will reduce the number of actual cancellations of flights on the supply and demand sides and replace them successively with another model. AVINOC attaches great importance to promoting the self-regulatory nature of the market.

#### **6.4.2 Point2Point-Smart-Contracts (P2PSC)**

The existing Blockchain will be adapted with a generic P2PSC system. This allows the use of advanced smart contracts that are concluded between two market participants. The digital contracts are fully compliant with the law with regards to national or international judiciaries and especially in terms of aviation law considerations. They merely represent an expanded electronic image of conventional contracts and are clearly identifiable by signatures. The connection happens the same way as the beginning of a business relationship, consciously and temporarily, under full control of

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<sup>31</sup>Natural disasters, geopolitical circumstances, major weather conditions

<sup>32</sup>This is usually done by AVINOC's built-in interfaces and apps, and subsequently by third parties as part of open source thinking or strategic partnerships.

the business partners. The basic hierarchy model is independent and allows network or island-like connections between the participants. All participants retain full control over their contracts and can freely decide which network structure they want to form or belong to. The Blockchain serves as the basis for triggering the contracts, whereby parameters for quantities can be included on triggers. The Blockchain also helps to gain information about potential partners or suppliers. The P2PSC in AVINOC are activated by triggers (transactions) via Blockchain. Here, too, in accordance with economic parameters, transaction costs are incurred, which can be individually negotiated and designed between the partners by means of a contract. Multiple triggering, with additional (quantity) parameters available in the Blockchain, is possible<sup>33</sup> as well as the one-time triggering of a contract and its subsequent termination<sup>34</sup>. Contracts can also be entered "freely" into the system and found via flights in the Blockchain of each or only a limited number of users (see 6.4.2.1). The offering of tickets for empty flights, for example, is such a contract. With the help of the P2PSC, the degree of decentralization of AVINOC increases. Individual contracts can be concluded according to current law, but they can still be managed and executed completely electronically (see 6.4.2.1). In addition, contracts in AVINOC comply with aviation law requirements and fully obey the terms of transport of a company. An elaborate design of a code logic is not required. The contracts include bidirectional criteria to set contract terms top-down or bottom-up<sup>35</sup>.

For BizAv companies as well as for the related aviation infrastructure and supply industry, this means an easy way to transform existing contracts with suppliers into the digital world without any noteworthy effort. Furthermore, the possibility to immediately conclude and execute a contract without further manual input as well as immediate payment by means of AVINOCoin, that are integrated in the Blockchain, constitute significant additional benefits. In the end it will form a cohesive, global "organism" in the form of a decentralized marketplace network within BizAv, There is no compulsion, each participant of AVINOC can decide completely independently, based on the information available in the Blockchain, who to commission as supplier (opt-in), which customer to fly with or which operator to choose. P2PSC creates islands that can chain together without constraints and autonomously. The Blockchain serves as "activator" on the one hand and as "executor" of the defined contracts on the other hand

**6.4.2.1 Smart Treaty Procurement (STP)** P2PSC introduces order and contract management within AVINOC. Contracts contain the complete, digitally usable specification of the desired order and are digitally signed. For the purpose of complete automation, contracts that are interdependent can be triggered by the Blockchain. This results in a chain reaction in which all contractual components and contracts of subcontractors and their suppliers are themselves triggered. For example, an open contract representing an offered flight is booked by a customer on the Internet under its contract terms. The flight sets off a cascade of further, one-off or permanent contracts with e.g. connected to the personnel (pilots), fuel suppliers or handling agents. This cascade is

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<sup>33</sup>e.g. Contract with a fuel supplier and triggering of a certain amount of fuel in the refueling process at a certain time

<sup>34</sup>e.g. buying a ticket or operating a flight

<sup>35</sup>e.g. directly executable by the system, terms of cancellation on the customer or operator side, discounts, etc.

activated by a single trigger in the Blockchain, the booking and payment of the ticket, immediate and legally valid. Thus, AVINOC allows the full empowerment of the customers with just one click. The Blockchain takes over the cascaded triggering of all connected orders and makes it possible to compare the financial status of all involved parties or to present this availability in advance<sup>36</sup>. The customer can only book the flight if he has the required amount of AVINOCoin in his wallet. Automation or triggering of further orders to subcontractors is also possible with a parameterized token. For example, the parameter could contain the booked seats. On the supplier side, for example, the quantity of fuel is defined and settled promptly. Linking the contracts provides AVINOC with an instant information and financial flow that promptly provides status updates in the Blockchain. The affected containers (aircraft, flights, suppliers) are thus always kept up to date and other participants in the system can adjust to it - again automatically, according to their contract cascades.

An essential element of this approach in AVINOC is the protection of trade secrets<sup>37</sup> simultaneously coupled with transparency of all processes defined by the Blockchain architecture (see 6.3.1 on page 21) and status. In the generic approach, contracts are negotiated only between participants who know each other (mesh, see also 6.4.2 on page 25). Contracts with legal character will be digitally signed. Contractor and client can freely define their contracts and all further dependencies. The token can be processed using client contract management provided in AVINOC. This approach provides the possibility to integrate AVINOC in a carrier in stages - thus effect a smooth change. Companies can freely decide which contracts to define and which partners to work with, once, permanently or even parameterized, in the course of permanent agreements with suppliers on suitable terms.

**6.4.2.2 Bidirectional Smart Criteria (BSC)** Bidirectional Smart Criteria are applicable in every contract at will and can be defined by the user or the contract partner according to the possibilities in AVINOC. They define certain parts of the contract, that need to be fulfilled, in digital form. They are readable fully automated, standardized and can be passed on to suppliers if required. Each supplier can add further criteria (hierarchy) and pass on the existing ones. Here, certain criteria may be mandatory, such as the definition of the number of crew members for a flight, or the minimum amount of fuel that the aircraft needs for holding and reserve. Thus, on the one hand, it is possible to prove that own supply contracts are valid under the criteria of higher-level orders and, on the other hand, that the conditions of flight safety can be fulfilled. This makes possible

- the "the contract guarantees", an assurance with regard to the feasibility of the services included in the orders (was the right services ordered on the right conditions, in the right quantity, in the right quality, etc.),
- knowledge about data properties (criteria) to tier-n without seeing actual data and trade secrets (zero-knowledge-proof),

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<sup>36</sup> e.g. in case of insufficient funds, supplies or resources available to a contractor

<sup>37</sup> No knowledge of third parties regarding internal processes, contracts, volumes, etc. across all tier, ie < tier n-1 or > tier n + 1

- the strengthening of aviation security and
- the traceability via the corresponding triggers in the Blockchain in the sense of a complete log

### **6.4.3 Infrastructure data**

All aeronautical infrastructure information relevant to flight operations, such as weather information, NOTAMs, ATC concerns, warnings, etc., even if it is purely data, can be accessed and treated as services provided by directly involved suppliers within the AVINOC scope, using P2PSC and getting paid for with AVINOCoin. Here, too, is a progress from fixed costs and lump sums to real costs of services actually obtained. This leads to cost reduction for aviation companies and an increase in quality on the part of the providers, since services can now be evaluated more in detail due to the increased transparency.

### **6.4.4 Transactions, payment and costs**

In the case of transactions in the Blockchain, there are fixed as well as individual transaction costs agreed between market participants. These cover, among other things, the Blockchain operation and guarantee the required level of security and protection from malfunction and disruptive activities. In principle, apart from the one-time "purchase", ie the initialization of the object, the use of AVINOC means only variable costs. This allows complete and simple financial planning based on the order situation, similar to the resource consumption of energy or fuel. Here, AVINOC is able to show in detail all the expected costs based on the contracts concluded with the suppliers and the information available from flight planning. The flight customer thus receives a precise offer. Leaving aside the integrated payment system, whose prices depend on the market participants and their services, and which can be customized, the costs for all transactions within the Blockchain are low. The reduction of costs effected by foregoing intermediaries (brokers and their portal solutions) are fully visible to the company and are only marginally affected by transaction costs in the Blockchain. From the point of view of an airline or the aviation industry, AVINOC basically finances itself in operation.

## **6.5 Platform**

AVINOC is a Blockchain adapted for contract management, P2PSC. It is a mesh network Blockchain hybrid with autarkic nodes. Participants define permissions only on their data and only in the P2PSC system. The Blockchain itself in AVINOC remains permissionless, transparent and decentralized - true to the inventor's intentions.

### 6.5.1 DAPIs, 3rd-Parties, Standards

In addition to the functionalities already explained, AVINOC offers distributed interfaces (distributed API, DAPI) for third parties<sup>38</sup>. All data is stored in AVINOC in SI<sup>39</sup>-units only, including aviation data. Therefore, the first release also includes the implementation of conversion functions for input to and output from the system, which are freely configurable depending on the region and operation on the user side<sup>40</sup>

. AVINOC effects the standardization on the database and ensures complete compatibility in accordance with a homogeneous and integer database<sup>41</sup>.

### 6.5.2 Approach and stages of development

The technical implementation of the AVINOC Blockchain is effected in the form of several consecutive logical development stages. In Stage one, the basis of the Blockchain incl. all necessary standards (see 6.5.1)) is developed, which already enables the integration and provision of all relevant data of all market participants. Containers such as aircraft and crews are already included. At the same time, the development of DAPIs and clients for 3rd party applications takes place. In a second step, further infrastructure (containers), such as suppliers of fuel, handling agents, etc, will be implemented in the already executable model. In Stage two, development of the P2PSC system will be effected at the same time in order to design the contracting<sup>42</sup>. In the third step of development, the platform for authorities, ATC etc. will be opened and further infrastructure as well as further smart criteria will be added.

The development of 3rd party applications can take place at the same time at all stages of development, if necessary. Integrating the open source community into the project is a key aspect, however AVINOC will determine the when and how up to the implementation of all planned applications.

The initial roll-out after the first development phase will be effected after the construction and configuration of the infrastructure (nodes) and is expected to take place in Q4 2018. We will make use of already existing resources of our partners and adapt them according to the required and predicted capacity and load requirements. We work with GitLab internally and for distribution on our nodes. In accordance with the requirements, we set up different projects / repos and always use three branches. Initially, only our production branch will be available on GitHub. Up to a date yet to be determined, the corresponding repos / projects on GitHub can only be changed by the AVINOC team<sup>43</sup>. Roll-outs are then scheduled after the first (Genesis) release (CD / CI). Corresponding

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<sup>38</sup>Platform provider, app developer, open source community, etc

<sup>39</sup>SI, international size and unit system with 7 basic sizes

<sup>40</sup>For example, Western Europe uses aviation nautical miles (nm) to indicate distances. For passengers, these are shown in km, but Russia, for example, also uses aviation km.

<sup>41</sup>This feature is already implemented in AVINOC - the ERP solution - and has been in successful continuous operation since 2008

<sup>42</sup>initially with a sufficient set of smart criteria

<sup>43</sup>Irrespective of this, expansion projects by third parties can emerge as independent entities at the same time- feel free.

schedules will also be published. Any source code for Blockchain (Core), DAPIs, etc. will be available on GitHub via our account<sup>44</sup> and maintained by our team. We have registered a large number of avinoc.\*-Domains in advance for corresponding projects or side acts. These will consequently be used from project start and support AVINOC as a brand or during the implementation of community projects and events.

## **6.6 Competitors**

Competitors are companies that have a competitive relationship with AVINOC as a provider of comparable services. The competitive relationship exists if both parties attempt to place similar services within the same group of users and thus affect the competitive behavior of one another.

In the context of our services, a distinction must also be made between the technologies used (Blockchain / conventional). The target group is the same for all competitors, however, the use of Blockchain technology drastically improves the approach and accessibility of the target group.

### **6.6.1 Competitors - Blockchain Technology**

Analyzes of the Blockchain or "crypto world" have not yet identified any direct competitors who have made it their business to deal with empty leg flight issues, intermediaries or the handling and operating business in BizAv. AVINOC is currently the only Blockchain solution for BizAv worldwide that is being positioned on the market according to its system purpose and content (see 6.3.4 on page 22).

There are already Blockchain projects in the related environment connected to the subject of GA or BizAv, but are part of the periphery of the AVINOC solution. There exists, for example, "aeron" (<https://aeron.aero/>), who have made flight schools, pilots and consequently the increase of aviation security through transparent logs their system focus. "Windingtree" (<https://windingtree.com/>) serves the aviation-related scheduled airline business, trying to replace global players and well-known travel platforms in this area. The GSC Aviation company, which has not yet appeared in public, is planning an ICO to operate in the supply chain in the MRO area (<https://www.linkedin.com/company/gsc-aviation/>). All of these companies are not in fact direct competitors because of the services offered and therefore do not pose a threat to AVINOC. We rather see opportunities for cooperation and a possible connection of solutions and knowledge, because these solutions could complement each other.

### **6.6.2 Competitors - conventional (not Blockchain) Technology**

There is a number of apparent competitors and existing solutions in the current non-Blockchain world. However, due to the technology used, these, unlike AVINOC, can meet the challenges posed only to a very limited extent. First and foremost there is the "avinode" platform, which has become one of the world's largest marketing and advertising platforms for business charter flights. The

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<sup>44</sup>The account already exists under the name of AVINOCICO, <https://github.com/AVINOCICO>

business model of avinode, however, differs in all the important ways from what a Blockchain solution requires or makes it possible. Unlike AVINOC, avinode is set up centralistically. Direct booking e.g. is not possible in this system. Tests by the FDSC showed that 9 out of 10 flights offered by avinode could not be executed. In addition, there are high costs for access, which is controlled by avinode alone. In our estimation, avinode is unlikely to be able to fundamentally change its own business model and operational structure in the near future to launch an AVINOC-style block switching solution. Aside from avinode, there is a large number of platforms dedicated to the specific subjects of empty flights or charters in BizAv. However, these ever only address a specific area or problem area of GA or BizAv, but not the entire area, as AVINOC does. In addition, these are not based on Blockchain technology either; they are economic islands and barely connected and thus have the same basic issues as all other non-Blockchain solutions.

Judging from the the lack of technological solutions on the market, combined with the inflexibility of many established companies, we see only a small risk of getting a serious competitor at the start of AVINOC in 2018. This assessment furthermore suggests that the use of Blockchain technology is not a primary business goal of many companies, since the topic itself as well as the "intrinsic system understanding" seem to be absent in many places. We can therefore make the most of our technical and technological advantage and the flexibility of our start-up.

## 6.7 Quality and risks

We serve aviation with our system. This is an economic sector that we consider to be particularly worthy of protection and whose integrity is to be upheld. Therefore, we avoid unwanted risks already in the planning phase and, in doing so, also proceed according to the ISO 9001 model in order to meet the highest quality standards. Regarding regulations, we would again like to refer you to the already existing provisions in our general terms and conditions (<https://www.avinoc.com/terms>), which allow us initial, international business operation.

**Regulations** AVINOC includes a token (or coin) to handle the cash flows in the Blockchain and to supplement the information stream. AVINOC is aware of the risks that crypto currencies are currently experiencing. We are also aware that, in the current spirit of optimism, many countries and public authorities can not keep pace with progress. This may create uncertainties in the use or implementation of Blockchain solutions with payment function in countries that generally provide legal certainty. Therefore, new regulations are being introduced in many places - and will be so with increasing likelihood in the future - that could also affect AVINOC. Due to the current situation, we have therefore chosen Hong Kong as our location because it gives us a degree of legal certainty, at least for the next two years. The use of AVINOC must be possible worldwide and remain secure during the course of market entry and, consequently, operation. We therefore strive to cooperate with the main aviation authorities (FAA, Eurocontrol, etc.) and international organizations (ICAO, IAOPA, IATA, etc.).<sup>45</sup> Likewise, we

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<sup>45</sup>Corresponding measures have been started.

are trying to uphold AVINOC in its system purpose and to ensure the aspects "transparent", "decentralized" and "permissionless", while keeping it compliant with all existing regulations of the financial market. In order to achieve this goal, we work only with certain agencies and partners (eg coinfinity, blockpit) and list our tokens or coins only on exchange markets that follow the relevant regulations. We strongly oppose money laundering and the financing of illegal activities and plan and develop AVINOC with special regard to these aspects. The same procedure was already followed during the development and operation of the ERP- Cloud (Aviation Network Operation Centers), to pass the biannual audits of the Austrian Aviation Authority (BAZ). It was paramount to avoid any risk of losing of operational effectiveness and to ensure the highest quality in terms of safety, stability and conformity.

**Development** Looking at the expertise of our team and its composition, we see only a very low risk of not reaching our goal. Nevertheless, we counteract it with seminars and permanent, life-long learning - last not least from other team members. We are especially concerned with the understanding and the underlying philosophy of Blockchain. Regarding the development location Graz / Austria and its organization and human resources development, we see a slightly increased risk of not being able to hire suitable personnel in a timely manner. We are already aware of that issue and have therefore taken appropriate measures and if necessary, our partners can support us. Purchasing technology or outsourcing development is not an option for us. The quality of the services currently available on the market for Blockchains either does not meet our standards or it is too expensive. Likewise, security aspects must be observed in order to protect the interests of our community. We like to split up the work and we value distributed work as well as creativity, and we recognize the knowledge of our employees and partners as the most important asset of AVINOC. Therefore, we attach great importance to a stable company, in order to avoid the risk of knowledge drain through personnel turnover. Corresponding measures for knowledge management have been mapped. One essential approach is to avoid complexity and rigid hierarchy within the organization - it has consequently been planned flat and highly interconnected.

**Systems/Infrastructure** Our world is changing, attacks on the cyberspace are daily occurrences. Our team has gained more than 10 years of team experience in operating highly sensitive systems on the Internet. The same has been true for the security of wallets, be they "cold" or "hot", since 2014. This has allowed our team to develop a very good awareness of security issues within this context over the years. For us, the GDPR also represents an instrument of security for the EU<sup>46</sup>. We are committed to security-by-design, which allows for cost-efficient operation. All our systems and security solutions are developed in-house. We almost exclusively use software that has proven itself or could be intensively tested. We abstain from the purchase of software whose source code we can not see. However, this increases the need for quality control and quality assurance. We are counteracting this by using solid quality

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<sup>46</sup>see. Various studies of the "Big 4", KPMG Cyber Security 2016/2017



management and have already defined appropriate functions

**Crypto-currency** risks are currently prevalent in the crypto currency market. Therefore, payment for goods and services is often only possible with the help of "intermediaries" in order to reduce losses due to exchange rate risk. For the stability of AVINOC in its Utilization phase, we have designed a system in which the price or performance can remain stable, independent from external price fluctuations that could affect AVINOCoin and the trading within AVINOC<sup>47</sup>. We minimize the risk of jeopardizing the development budget through price fluctuations on the market after the sale of tokens by means of sound financial management and the constitution of reserves. We focus more on the security aspect of keeping a certain proportion of Fiat money available and less on the possibility of speculating on the amount of crypto money (ETH / BTC) purchased<sup>48</sup>. We calculated the development budget according to these criteria, and, gradually, the selling price of our tokens and the underlying distribution model will correspond to them<sup>49</sup>. We would like to state that in the world of crypto-currency there cannot be any precise predictions about the development of courses over a longer period of time (at least not from today's perspective). Therefore, the financial security of our project and thus the securing of the development budget, including all accompanying measures (marketing, sales, strategic partners, etc.), is more important to us than a high, but highly uncertain speculative profit<sup>50</sup>. We recognize the potential of the crypto world, understand its character and are responsible for our employees and their families in the here and now. With AVINOC we try to establish a solution with which we will be able to move with all the "streams" in the real world in the near future.

**Aviation** Risks in aviation or competition of the industry have already been discussed in the chapter 6.6 on page 30. We consider the risks of a changing market, which could endanger the development of AVINOC, as very unlikely to occur because of the inertia of the market and our organizational structure and solution. The risk of not being able to enter into the necessary strategic partnerships is estimated to be equally low, as aviation is always striving to optimize profitability and to increase security. Likewise, we are pleased to see that the aviation sector is currently undergoing major changes and major manufacturers, such as Boeing, Airbus or Air Asia are beginning to implement Blockchain solutions. To minimize further risks in terms of market development, appropriate funds have also been budgeted (see Use of funds).

**License** for aviation business. At the moment, we do not need any aviation business license to develop and consequently establish AVINOC. Likewise, our system is not primarily relevant in terms of air traffic safety, it has no direct influence on the process of air traffic nor does it

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<sup>47</sup>Further information will be published at the release of AVINOC.

<sup>48</sup>AVINOC is not intended as a speculative investment vehicle.

<sup>49</sup>We would like to point out explicitly that we can make changes depending on the situation, according to our terms and conditions. This is done solely to protect AVINOC and its community.

<sup>50</sup>see 6.7 on the following page

deal with the quality and certification of, for example, spare parts. Air traffic regulations or their changes therefore represent only a minor risk restricting operations. AVINOC primarily serves the business side of the market and allows status inquiries about information that has already been verified by means of the needed qualifications of the participants - and only enter the system if the contracting parties are in agreement. This also implies the use of BSC, which may be required from the query side. The responsibility to provide data in a manner relevant to aviation law lies with the respective participant. In this context AVINOCchain checks the quality of the data (by design) and enables an integer basis. If necessary, our experts are able to obtain further approvals, which comply with all aviation regulations in order to have AVINOC certified in this regard.

**Scenario-analysis** analysis. We refrain from a scenario analysis, but note that, according to initial cost estimates, sums below USD \$8 million would mean greater uncertainty in the development of AVINOC, including all accompanying measures, regarding a successful launch, or that it may be delayed. More precise statements can be found later in the implementation business plans.

## 7 Development projections for the future of BizAv in 2025

In a 2010 Delphi study conducted by the European Business School (EBS) in Paris, France, a total of 25 projections were developed on seven topics (customer behavior, growth drivers, value added, business models, environmental factors, substitution potentials and technologies). The following excerpt provides a brief overview of interesting future scenarios in the context of the potential development opportunities and activities of AVINOC. [see. Lang u. a., 2012a, S.97ff]

- New, smaller aircraft and jet types that allow long haul flights and transatlantic point-to-point connections will be available to BizAv.
- Traffic from, to and within emerging markets (especially Brazil, Russia, India, China and the Middle East) will be the main business aviation growth drivers.
- Demand for business aviation will exceed the projected annual growth rate for general aviation.
- Business aviation will increasingly provide access to remote areas and free trade areas.
- Airport dedicated to business aviation airports will develop.
- Very light jets (VLJs) and air taxi services will increasingly be used to meet short-distance demand (see, e.g., Eclipse 550).
- Number of medical transports in chartered business jets will increase sharply.
- Chartered business jets will increasingly be used for emergency freight transport.

- Business aviation customers will increasingly demand efficient and convenient aviation services without time loss.
- Business aviation customers will increasingly demand integrated one-stop door-to-door services (one-stop-shopping).
- The use of business aviation is socially accepted.
- Members of the business aviation transport chain (airlines, airports, air traffic control, etc.) will work together in system partnerships

## 8 Outlook - Development Potential for Airlines and Charter

Even in scheduled and charter flights, intermediaries in the form of booking platforms and price comparison portals have entered the market in steadily increasing numbers over the past 20 years. The original idea behind these intermediaries was to increase the transparency of available offers from the airlines, which would, on the one hand, increase the potential passengers' benefit through better access to information, and on the other hand improve the airlines' potential capacity utilization.

Since then, however, the platforms' and portals' market power has grown to such an extent that, on the one hand, the airlines' contribution margins have come under massive pressure, caused e.g. by the portals pitting the airlines against each other through artificially created intransparencies, quotations, etc., and on the other hand, air ticket prices for customers are sometimes far above the regular prices offered by the airlines because of additional fees charged by the platforms. Moreover, bookings via these portals are often cumbersome and sometimes intransparent. In particular, hidden costs and obscure contractual components make it difficult to reverse the contract and/or take appropriate action in relation to applicable passenger rights agreements. In addition, operating expenses for airlines have been increasing, due to the need to deal with these providers. The airlines are forced to provide and maintain staff and appropriate systems and interfaces for data exchange (costs, overhead). There are other problems as well, e.g. customers receiving different prices for the same flight offered, sometimes without the actual provider's - the airline's - knowledge, the prices depending on different parameters (that are determined by the tracking of their activity and are time-related or place-related) as well as on changing booking situations. In a nutshell, intermediaries in the context of the airline business, have assumed a market-dominating and market-dictating position beyond their system purpose. Neither passengers nor airlines are the winners here, since direct contact to the customers must first be made via a portal and information will therefore get lost on both sides. Many airlines have started to discontinue to use this system or are considering it, yet doing so means a loss of market access. Cost-intensive measures are or will be required to compensate for this. However, isolated solutions will not work as well as globally implemented solutions due to a higher fixed cost share. This and the wish for capac-

ity compensation leads to the forming of alliances, which result in intentional as well as unwanted dependencies.

AVINOC is able to solve these issues of the scheduled flight or charter flight sector by creating the corresponding basic data layer or the replacement layer, in the sense of the described solution for business aviation. AVINOC is a generic and non-complex system. It does not favor anyone and does not exclude anyone (permissionless), which also implies that airlines can participate in AVINOC, and AVINOC will and can never prevent it. From marketing to price comparison and finally booking, AVINOC allows airlines direct contact to the customers, while creating the greatest possible transparency for offers and prices at market conditions for all market participants.

AVINOC's Blockchain, Contract Management STP ( 6.4.2.1 on page 26) and Bidirectional Smart Criteria BSC ( 6.4.2.2 on page 27) can be used "as-is" without additional expansion or customization for operational use in airlines for ticket booking and payment, but in principle also for all other operational activities. Catering, for example, could be further optimized, made more individual, and the current overhead costs of services could be reduced. An optimal amount of service objects carried in the aircraft (food, drinks, etc.) would also help save fuel costs. At the same time, the customer's empowerment lost through intermediary platforms is re-established through the possibility of simple direct bookings (with AVINOC practically via "the billboard") to the airlines. Services can be obtained "just in time", according to availabilities, before as well as during the flight.

Intermediaries, in the form of booking platforms and price comparison portals, will no longer be required. The equilibrium of the airline market will restore itself through the claims originally defined by the customer (quality, performance, service, security of execution, transfer times, etc.), and the market will no longer be influenced by intermediaries. With AVINOC, customers can book individual contracts (tickets) offered by the airlines as well as individual additional services<sup>51</sup> on-ground and in-air, on-demand, the crucial aspect being that no additional effort on the side of the airlines will be involved. No additional equipment or staff will be required for the execution of operational activities using AVINOC. These activities can be carried out by the existing staff without any extra effort<sup>52</sup>.

With AVINOC, individual, automated contracts between airlines and BizAv partners are possible, for example, combining contracts, e.g. allowing passengers of a transpacific flight further transfer by air taxi or other means of transport to their final destination<sup>53</sup>.

No additional organizations are needed for the processing. Time and effort from a professional and technical point of view can be minimized as subcontractors in the transfer business can use AVINOC easily and without access restrictions.

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<sup>51</sup>such as food and beverages as well as some additional services such as transfers, etc.

<sup>52</sup>Example of "individual catering": The passengers can receive service on-demand. This is provided by the cabin crew and the passengers pay directly via smart device via the Blockchain. In this case, photographing a QR code on the desired object, e.g. on a beverage bottle is basically all they have to do. The cabin crew can - but does not have to - carry additional equipment for the handling (smart device). The cabin crew does not have to carry out any further administrative work after the provision of the service, or to suppliers or the operations center. All information is already available on the ground and the caterer can order the new contingent according to existing claims (reservations) or forecasts for the next time the aircraft will be used, at the correct terminal, automatically and in suitable quality, using STP / BSC (full automation).

<sup>53</sup>Current need for use cases for transfers in the Maldives / Asia / Africa / Oceania ...

The use of AVINOC in scheduled and charter traffic creates a win-win situation for airlines and customers, generating higher contribution margins on the one hand and lower prices on the passenger side through the full automation of all relevant processes.

## 9 Team

The development team of AVINOC is international, it is formed in a company in Austria. It consists of aviation, business, logistics experts and experts in the development of complex IT systems and Blockchain solutions. More than 150 years of experience in IT, business management, aviation and, since 2011, in the field of Blockchain technology, make possible substantial development and a sustainable solution. In the development and project team, as well as in strategic and operational functions, partners, advisers and employees of the respective partner companies or founders are involved. It is gradually being expanded with national and international expert staff. In the first instance, we strive for cooperation with Graz University of Technology (TU)<sup>54</sup>, the Graz Know-Center<sup>55</sup> of the TU Graz and University of Graz, the Karl-Franzens Universitaet Graz<sup>56</sup> an. The infrastructure for the operation and development of the Blockchain, including all technical equipment (network, platforms, internet architecture, git, etc.), has been in use with partners since the beginning of AVINOC's planning. It allows the team short reaction times, modern and solid teamwork and location independence, while taking into account all safety-relevant aspects. All major developments are done in-house. Find below a short introduction of the members of the AVINOC team, which will be formed for the development project as a separate company after the closing of the public sales phase

### 9.1 Development & Area of Aviation Expertise

**Michael** Linder, Ing. MSc., CIO

Michael is an enthusiastic and creative team player who is passionate about introducing new enterprise IT technologies, including AVINOC. He completed his education as a software engineer at the HTL Villach and holds an IT Business Solutions Master of the Alpen-Adria University Klagenfurt. He worked for ATOS and addIT for a long time, where he realized projects for well-known clients such as Siemens. Michael now owns Strali Solutions. With his company, he supports national and international clients in the implementation of their projects. The focus of the service spectrum lies in IT consulting, digitization, productivity solutions, system and software architecture, as well as software engineering and IoT. Since 2017, Michael has also dealt with the introduction of Blockchain technologies in the industry. Michael will take over the role of Chief Information Officer at AVINOC (CIO)<sup>57</sup>.

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<sup>54</sup>Technischen Universitaet Graz: <https://www.tugraz.at/home/>

<sup>55</sup>Know-Center - TU Graz: <http://www.know-center.tugraz.at/>

<sup>56</sup>Universitaet Graz: <https://www.uni-graz.at/>

<sup>57</sup>LinkedIn: <https://www.linkedin.com/in/achildrenmile/>

## **Peter** Skerl, CTO

Peter is the team nerd. He has been involved in software development since his childhood<sup>58</sup>. Peter completed his education in communications engineering and studied telematics. He has developed complex systems for the Austrian military<sup>59</sup> and performed contract work for international corporations for many years. Peter was instrumental in product development for land and water-based GIS solutions and architect of the ERP Cloud at the Aviation Network Operation Center. As a Blockchain developer and software architect, Peter today provides international companies with solutions in the area of crypto payment, cloud mining and security solutions. His experience with crypto currencies and Blockchains goes back almost to their origins. Peter will fill the position of Chief Technology Officer (CTO) at AVINOC.

## **Karl-Heinz** Mali, Aviation Professional (ATPL/Examiner), Advisor & Project Management

Karl Heinz started his first own software company after his engineer training. He was a leader in software development for medical imaging in Austria. In 1994, he founded the company Mali Air (ICAO code "MAE", see also [https://de.wikipedia.org/wiki/Mali\\_Air](https://de.wikipedia.org/wiki/Mali_Air)) with his first aircraft, a Cessna 340A, concurrently to his software development company. In 2005, the first jet, a C501, was added and today the fleet consists of 8 aircraft as well as an Eclipse 550 (which is currently in the approval phase). In 2017, Karl Heinz took over a flight school, the Austrian Aviation Training GmbH, for the line pilot training of pilots of Austrian Airlines and other airlines, with 8 aircraft and a simulator. In addition to working in his company, Karl Heinz also acts as an advisor for software issues and technological developments at international corporations. He is also an airline pilot and an examiner for airline pilots and professional pilots (ATPL / Examiners ATPL & CPL). Karl-Heinz assumes the role of advisor, project manager and customer service for the aviation industry at AVINOC<sup>60</sup>.

## **Florian** Hye, MSc., Quality Management & Aviation Advisor (ATPL/TRI)

Since 2004, Florian has worked in both business aviation and software development. He holds a Master in Management. He supervises software systems at the Medical University of Graz where he is also responsible for the quality management. Through his work as a professional pilot, he was able to study the basics and requirements of the business starting from the very bottom and continually develop improvements to optimize processes and routines in planning and logistics. As part of the FDSC, he manages a large number of airlines in the areas of scheduling, administration and logistics. Florian is an airline pilot with the required pilot licenses, such as ATPL (A) / TRI. He will take over quality management at AVINOC. This implies the support of the requirements management up to all concerns, which occur in the support management <sup>61</sup>.

<sup>58</sup>CLs: C, C++, Pascal, Smalltalk, Assembler, Basic, mapScript, JavaScript, C#, Java, PHP, Prolog, Modula-2, SQL, plpgsql, Lisp, Delphi, Lua, Objective-C, Occam, Self, Python, Solidity, D, etc. DBs: dBase, IBM-DB2, ObjectStore, MS-Access, MS-Jet Red, dpx, MS SQL Server, SQLite, MySQL, MaxDB, Oracle, Postgresql, several NOSQL, ...

<sup>59</sup>Austrian Armed Forces (AAF)

<sup>60</sup>LinkedIn: <https://www.linkedin.com/in/karl-heinz-mali-02123764/>

<sup>61</sup>LinkedIn: <https://www.linkedin.com/in/florian-hye-5588a1156/>

**Rene** Inkret, Requirements Engineering, Aviation Marketing & Advisor (ATPL)

Rene, like Karl Heinz, is a professional pilot. Since 2004 he has been working for national and international airlines and has gained experience in flying different business jets around the world. He is familiar with demand aviation and taxi industry, including all their problems, and can approach them from the pilot's perspective as well as from the point of view of a dispatch company. He provides AVINOC with essential information on the technical or operational process and all organizational matters within the business. Since 2014, he and his dispatch company FDSC have been in charge of aviation companies and customers in the field of business aviation in Europe. As one of only two companies, his is certified to carry out organ transports. As a market insider, he controls the planning and logistics of flight operations with his background knowledge. Furthermore, he is in possession of an corresponding airline pilot license (ATPL) and various ratings. Rene is responsible for technical requirements engineering at AVINOC as well as for project management and customer service in the business sector <sup>62</sup>.

**Jakob** Hohenberger, Advisor Software Development & Product Development

Jacob's greatest talents are his curiosity and the urge to use with economical success what he has learned to make ideas a reality. At 14, he founded his first company. Today, he is CEO of a rapidly growing group of companies with more than 30 highly qualified employees. His expertise lies in software product development (Guid.New GmbH) and chatbots (VEA GmbH, Botential) as well as artificial intelligence. Jakob worked in software development for the Austrian industry. There he worked for clients like Magna or Mercedes Benz. Jakob will take over product development at AVINOC<sup>63</sup>.

**Song** Jie Hong, Advisor, China & Canada

Song Jie is our network professional in Asia and Canada. Song Jie has completed military medical training in Shijiazhuang. She completed a master's degree in international finance management in Beijing. After that she worked in an international company in Hong Kong. Today she is active in the real estate business, with offices in Beijing and Vancouver, as well as in the business development of General Aviation in China. Song Jie's experience has already allowed Mali Air to enter the Chinese market. Song Jie supports AVINOC in an advisory capacity and helps us enter the markets of China and Canada.

## 9.2 Marketing, Sales & Design

**Shayda** Osman, Mag, PR, Marketing & Sales

Shayda was responsible for the operation and PR of Influencechain.org in Europe. He worked as a manager at Raiffeisen Bank, ATOS and other well-known, international companies. He has a Master in Business Administration and Information Management. Shayda was an active player in the

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<sup>62</sup>LinkedIn: <https://www.linkedin.com/in/rene-inkret-3924a9114/>

<sup>63</sup>LinkedIn: <https://www.linkedin.com/in/jakob-hohenberger-916bb894/>

Austrian Soccer League. After retiring from sports, he focused on business development and scientific exchange between Europe and the Middle East. There he established the brand IRONBODY for fitness and health products. Shayda will be responsible for marketing and sales at AVINOC and will also build locations in the Middle East<sup>64</sup>.

**Petra** Peinsitt, Mag, Finance, Legal & Marketing

Petra is an organizational talent with in-depth knowledge of corporate governance and financial management, marketing & sales. For 7 years, she was responsible for Marketing & Sales at Red Bull and worked for another 7 years as branch manager and commercial customer advisor at BKS Bank AG. She contributed significantly to the success of these companies. Today, Petra is employed in a highly innovative Austrian start-up and supports the management as a management consultant in financial management, marketing & sales and human resources. Petra will take on an advisory role at AVINOC in marketing and support the company in the financial sector<sup>65</sup>.

**Jörg** Vogeltanz, Mag., Artdirector, Design & Media-Management

Jörg is a cross-media artist with a focus on comics / graphics, short stories / illustrations and videos. He is the founder and chairman of "edition preQuel", of "entrancexit" and "macGuffin". He is also director of several music videos and independent art projects (independent sequential art projects). He is a master of stage design and completed his studies at the University of Music and Performing Arts Graz. There he is now an editor for freehand drawing and computer-aided graphic design as well as graphic design itself. In an advisory capacity for illustrations and design, Jörg works for countless customers in Austria. He has been working on topics related to Blockchain since 2017. He is particularly interested in the transformation and transport of information to the user. He develops the necessary strategy and graphical processing. Countless samples of his artwork can be viewed on his website, <http://www.vogeltanz.at>. Jörg will take over the role of art director at AVINOC<sup>66</sup>.

### 9.3 Management & Operations

Management, organization and strategic management of AVINOC are handled by three people. The operational area is supplemented by additional employees for the back office, the financial administration and the strategic financial management. The location in Asia is managed by Xie, and Gernot and Robert will manage the implementation on the Austrian side.

**Xinyao** Xie, BA, Director, Promotion & Investor Relations (Asia)

Xinyao Xie earned a bachelor's degree in business management from the Vienna University of Technology. He is one of the co-founders of Influencechain.org. He has entrepreneurial experience

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<sup>64</sup>LinkedIn: <https://www.linkedin.com/in/shaydaosman/>

<sup>65</sup>LinkedIn: <https://www.linkedin.com/in/petra-peinsitt-b04a44159/>

<sup>66</sup>LinkedIn: <https://www.linkedin.com/in/joergvogeltanz/>



in the field of information and intelligent technologies. Xie worked as a consultant to China Union Pay and 99Bill as well as in some fund companies, business schools and incubators. He also undertook Internet projects in Austria and other German-speaking countries. His projects were favored by many well-known companies and always successfully acquired. Xie will take over the role of Director at AVINOC and support us in all matters relating to investors and the Asian community. Hong Kong is an important location for AVINOC to enter the Asian market. Xie is therefore also involved in the development of this region<sup>67</sup>.

**Gernot** Winter, Mag., Director, CFO

Gernot has been active as an operational manager and consultant at C-level for about 20 years. His focus is on strategic corporate governance, business development, finance, controlling and human resources. Gernot holds a master of business administration from the Vienna University of Economics and Business and is a certified restructuring law expert. He was managing director of an international Austrian crane manufacturer for more than 15 years. Gernot has been engaged in the field of Blockchain application and aspects of its introduction to business and industry since 2017. He has specialized in the economic requirements as well as the implementation strategy and the creation of the necessary environment in the course of change management. Gernot will initially assume the role of Chief Financial Officer (CFO) in an advisory role, and manage AVINOC in economic and strategic issues<sup>68</sup>.

**Robert** Galovic, BSc. MSc., Director, CBDO

Robert is the interdisciplinary universalist. He has been in the IT industry since 1999, working for international companies in software development, project management and consulting. He holds a master's degree in engineering and a bachelor's degree in physics. In addition to many other projects in the IT environment (networks, system architecture, ERP and management systems), he has been working on software systems for general aviation since 2007 - and IT in general since the days of C64. At the Aviation Network Operation Center, he rose from his role as backend developer and database architect to project manager and took over customer service. Robert has been dealing with cryptocurrencies since 2011 and with blockchains and AIs since 2014. He is in possession of the pilot licenses PPL + AFZ of EASA (dormant) & FAA. Robert will take on the role of organization and management on the technical side of the company and accelerate business development<sup>69</sup>.

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<sup>67</sup><https://www.facebook.com/influencechain/>

<sup>68</sup>LinkedIn: <https://www.linkedin.com/in/gernot-winter-85547496/>

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## 10 Document information

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