HKUST School of Engineering

Entrepreneurship Fireside Chat Series:
Dr. Zhang Yunfei on "A 10-year Journey from an Engineering PhD Student to a Revolutionary Entrepreneur" Transcript
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(Recording: https://www.youtube.com/watch?v=V2_rr8Z2xyE&t)

TC — Prof. Tim Cheng

JL — Prof. Jack Lau

ZY — Dr. Zhang Yunfei

TC: Good afternoon, this is Tim Cheng, Dean of Engineering at HKUST. I'm very pleased to introduce to you the 3rd edition of HKUST Entrepreneurship Fireside Chat Series. This is a live chat series featuring tech entrepreneurs, whose experience, ideas and vision can benefit and inspire the next generation of technology leaders, and who also have the passion to help nurture the young tech entrepreneurs in Hong Kong and help us to enrich our entrepreneurship education.

We had great turnout in the last two editions of our fireside chat series, and again, today, we have many participants being here. My warmest welcome to all of you today.

Today's chat will be conducted in Putonghua. From now on, I will switch into Putonghua for the rest of my introduction.

Today is our 3rd HKUST Entrepreneurship Fireside Chat. We are very honored and pleased to be able to invite an alumnus of HKUST, Dr. Zhang Yunfei. Yunfei received his MPhil and PhD degrees in Mechanical Engineering from HKUST in 2009 and 2020 respectively. Yunfei is the Founder and President of Zhuhai Yunzhou Intelligence Technology Ltd, China's first unmanned surface vehicles company. Zhang Yunfei founded Yunzhou with his HKUST classmates in Zhuhai in 2010. At the time, he was a doctoral student who just started his PhD studies. But soon, he won the championship of the start-up group in the 2013 China Innovation and Entrepreneurship Competition, and in 2014, he was elected as one of the "World's Top Hundred Young Innovators". Today, Yunzhou has developed into a globally-renowned high-tech enterprise with more than 400 employees worldwide and has become a leader in the unmanned boat industry.

Today, I would also like to take the opportunity to thank Yunfei and Yunzhou for donating two Dolphin 1 surface rescue vehicles to HKUST. We are extremely grateful. This is an exceptional product. I have tried it myself, and it is very easy to operate. Now we have these two surface lifeboats at the Clearwater Bay campus for emergency needs, which make us feel relieved. Thank you very much for this.

03:09

As a visionary, motivated, influential, and successful young entrepreneur and innovator, especially one who started from zero, Yunfei will share his experience and inspiration in this new and unexplored unmanned intelligent vessels industry as gained throughout his decade-long entrepreneurship journey.

Today, we are also very happy to invite, once again, a PhD alumnus of the School of Engineering of HKUST, and also a very successful entrepreneur, Prof. Jack Lau, to host today's fireside chat. So today will be a conversation between two alumni, and also one between two successful entrepreneurs. As a member of the big HKUST family, I feel extremely proud, and am looking forward to this very special conversation today.

Prof. Jack Lau is the first PhD graduate of HKUST, a professor, and also an entrepreneur. Jack is currently the Chairman of the Swanland.AI, and a member of the HKUST Council. Professor Lau was named one of the "Ten

Outstanding Young Persons" in Hong Kong in 2000, won the Young Industrialist Award in 2005, The Ernst & Young Entrepreneur Of The Year China Region award in 2009, and was awarded Honorary Fellow by the HKUST in 2010.

So, now we will start today's Fireside Chat.

JL: Hello everyone, good afternoon, and hello to you, Yunfei.

Yunfei, today we are all at Clearwater Bay, HKUST, where you spent almost a dozen years. But unfortunately, I cannot invite you to Clearwater Bay today. I heard that you are in your own office building right now, is that right?

ZY: Yes, we moved to our new office building in Zhuhai in April this year. I think the last time you visited with some of the other professors, we were still in the process of construction.

JL: This place is really exciting. I heard that it has more than 50,000 square meters, is that true?

ZY: Yes. Our building here is called Xiangshan Ocean Technology Port. It has a building area of 50,000 square meters. It's in Zhuhai situated near the sea, so we mainly conduct research, development and testing on unmanned surface vehicles here. Our company, except the manufacturing department, is housed here.

JL: Other viewers could see this very creative building. I see this is your conference room, right? It looks like a ship, like the deck of an aircraft carrier. Did you model your conference space after that?

ZY: Yes, this is our meeting room. Because we make ships, and we thought the deck of the aircraft carrier is very suitable as a conference room table, so we made it into a conference table.

06:54

JL: Yunfei, I know I will ask you a lot of questions about your company later. But first I want to ask... I see this photo. This is a photo with visitors at your company. What was the occasion? I saw there is a photo behind, right?

ZY: Yes, this is in our showroom. This picture you see is from 2014, when we joined the team led by Premier Li Keqiang to Russia to participate in the World Innovation Forum.

JL: That was extraordinary, participating with national leaders! Hey, is this a basketball court in your company?

ZY: That's right. Yes, currently, our workshop does not need so much space, so we made one of them into an indoor court... It is inspired by a similar indoor basketball court at HKUST. So, we thought we should have one at our company too.

JL: Yunfei, is this a photo of you? You look like the basketball star Kobe Bryant!

ZY: This is when I was in school, probably 10 years ago. Back then, I often went to the basketball court by Seafront to play basketball.

JL: So you must have always been at the seaside, tinkering with boats. Let's look at another photo. Because you are an alumnus, we are especially excited to see photos of you at HKUST. This should be when you graduated in 2009 with a master's degree. Was this you being onstage when it was awarded?

ZY: Yes, I graduated with Master of Philosophy in 2009.

JL: I also have a photo to share with you. Look at that, when I was still relatively young. It was 1994. I was in the same place, receiving my diploma, although it was about 15 years earlier than you.

ZY: Wow, this photo is very precious!

JL: Yes, for me, too. HKUST is very special to the both of us. This photo is you with your Master degree supervisor. I guess it is taken at the front door of the Department office?

ZY: Yes, we had four classmates graduating together that year, and we, alongside Mentor Gao Yongsheng, took a group photo together.

JL: This is very meaningful. Yunfei, I want to ask, how did you go from wherever you came from, to HKUST, then to Zhuhai? Actually, it seems that you have traveled across several cities, before finally settling in Zhuhai.

ZY: Yeah, for me… I experienced living in many cities while growing up, now it should be… So far, there are mainly 6 cities. The first one, from when I was born to graduation from elementary school, I was in Xi'an for 12 years. Xi'an is an ancient capital of 12 dynasties, and a historical and cultural city in China.

For junior high school, I went to Weihai, Shandong. Weihai is also a small coastal city. I think we all know the Jiawu Naval Battle took place in Weihai. Then for high school, I went to Shenzhen, Guangdong, which is very close to Hong Kong. After graduating from high school, for undergraduate studies, I went to Tongji University in Shanghai, so I stayed in Shanghai for 4 years. After graduation, I went to HKUST in around 2007.

After starting a business, I came to Zhuhai, where I've stayed for many years.

JL: Wow, Yunfei, that means apart from the first 10 years, the cities you lived in are all related to the ocean. Weihai is one of the earliest places in China to have naval forces, Shanghai as well. Hong Kong is known as the Pearl of the Orient and a famous seaport. Now you are in Zhuhai. I get it now.

Yunfei, of course I know that you like your business with unmanned ships very much. Almost every alumnus knows this. But could you tell us, did you like building boats since childhood?

11:13

ZY: Well, yes, I actually liked playing with vehicle models since I was a kid. My dad taught me to make models, but there are no photos of us at that time as it was still in the 90s. Later, when going to school, I would always join the school's model aircraft team. Afterwards, when the schools had technology groups, I would join them. So in the past, whenever I had spare time while in school, I would usually make some models, technology works, etc.

Looking at the pictures shared, these are the wooden ship models and the aircraft carrier model that I made in my spare time when I was in middle school. These are some model ships I built in the past.

Then, actually, many Shenzhen Experimental School alumni ended up studying at HKUST. So, several students in our research group ran into each other at HKUST, and we wanted to do something when we had spare time. Therefore, we decided to develop a small boat that could measure some pollution parameters on the water, and that's where the current idea of unmanned ships came from.

At school, the first boat we made was from modifying a model ship. Some sensors were installed, so we could measure some parameters related to water pollution on the sea at Clearwater Bay, then try to send the data back to our computer. After we had this idea, we planned for over the years, and until 2010, we thought we could start a business and set up a company to develop the product. Up to present, the photos that are being shared now show all kinds of unmanned ships. We also kept scaling up our models, turning them into products of dozens of tons, tens of meters for different purposes.

JL: Do you mean that the largest unmanned ship was dozens of tons? That's very big and incredible!

ZY: Yes, the biggest one being launched now is 50 tons, approximately more than 20 meters long. Since unmanned surface vehicles are beginning to have broader applications on the sea, different designs, with different tonnage, different kinds of hull platform are required to adapt to various working environments.

JL: Actually, Yunfei, I want to ask you about something. As we all came from the School of Engineering, from a technical perspective, what is the biggest difficulty in building an unmanned ship?

ZY: Well, from a purely technical point of view, the unmanned ship is actually a surface robot. The most important factor of a robot system on such kind of water surface, is to have a core control technology. The

technology includes, first of all, the ability to detect and obtain information about the surrounding environment using various sensors such as sonar, radar, images, lasers, etc. Secondly, it needs to have a certain ability to control motion and make decisions, for example, how to control the unmanned boat on water and move according to our needs, to carry out a faster, more accurate and safer voyage.

Then, the unmanned boat needs to have strong capabilities on its platform. In addition to control, it needs to be able to reach a certain speed. For example, our boats can reach the highest speed of 50 knots, which is about 80 to 90 kilometers per hour. This speed is considered fast for boats. For the same boat to travel that fast but also travel far, it needs proper endurance. For example, our most extreme model can travel up to 8,000 kilometers. It is a 16-ton ship. But it still needs better efficiency and so on.

So, the design of the platform will involve fluid power, material, structure, vibration and noise reduction, and other related design work. Alongside with this platform as well as control, it also needs the ability to communicate, such that unmanned boats far away from us in the middle of the sea are able to connect with those of us on shore. So in terms of communication, in fact, under different scenarios, it will use anything from satellite communications, broadband local area networks, narrow-band piezoelectric stations, and so on.

In addition to these, which include the communication system, the unmanned boat platform and core control, we need them do some work for us. Then, related to the tasks would be the technology of the instruments and equipment attached on it. For example, with environmental protection equipment, you can conduct environmental monitoring; with rescue systems, it can be used for emergency rescue on water. So, the integration of the sensors and the technical systems is a fourth consideration in terms of technology.

So the above aspects have to be solved before we can make an unmanned boat. It's actually quite complicated.

JL: Yunfei, this is fascinating. I would like to ask, while you developed this idea, Yunzhou, in 2010, how many years did you spend on research and development before selling the first ship? Did it take a long period of time? Because this does not sound easy at all, and if I remember correctly, it is only your company that is developing unmanned ships to such a large scale in the country. This industry was basically created by you.

There was no such thing before. There was no set requirement or standards for this industry to adhere to and know that you'll be fine as long as you follow it. The environment is also different. I remember from one of our previous interviews, at that time, you said that your first and earliest application of the unmanned ship was in this polluted lake to test the water quality.

Because it's dangerous for people to personally measure the water quality. So, how long did it take to build this first ship?

18:07

ZY: The first ship was sold towards the end of 2012, that is, two and a half years after we started our company. But even before the establishment of the company, we did quite extensive research and development. So basically, it took about three or four years to sell the first model, like the one in the picture, a small one for environmental monitoring.

JL: Actually, our viewers may not be able to see these three boats clearly. How big are these boats, roughly? At the beginning, it shouldn't be as big as 50 tons? How big were the boats at the beginning?

ZY: Our products are actually divided into several series. The first series is to, like the boats in the picture, conduct environmental monitoring. Its size is about 1-meter long. It's actually relatively small, around 1 to 1.6 meters. For this type of product, we have been doing research and development for about three or four years, and launched it around the end of 2012 to the beginning of 2013.

The one shown now is relatively bigger, this one is about 2 meters long. It weighs about 200 kilograms, it can run with more equipment and is more powerful. This is a new product that we launched last year. The main application of ships in this category—it runs in Lop Nur, known as the Sea of Death -- the main application of

this type of product is to measure water pollution, its environment including its depth and underwater terrain and related work.

This picture now, shows our second category of products. The second series of product is mainly for ocean exploration related work. This picture is the Western Artificial Island of the Hong Kong-Zhuhai-Macao Bridge. Because as we know the segment between the east and west artificial islands is an immersed tunnel. At this stage, the unmanned boat carries various sonars to detect any deformations in the immersed tunnel. The size of these products range from 1 ton to several tons. We started development at the end of 2011, and officially launched last year, after 8 years of development.

This is another one, in Antarctica. I went to Antarctica in 2017 to participate in the Antarctic scientific expedition. This is in the waters of the Ross Sea. China was preparing to construct its fifth Antarctic research station. Before constructing the scientific research station, we had to transport all kinds of materials to the shore via MV Xue Long. MV Xue Long needed to drive to the sea here, the Ross Sea which we've never been to. But we needed to know how the underwater terrain looks so that we could know whether the ship could go through, and where the anchor should be set so that it could be safer. So through the unmanned ship, we explored this area to survey the water and map out safe regions for anchoring.

JL: Wow, Yunfei, this is really not easy. This means that all the boats in Yunzhou go to places where no one dares to go, no one has ever been to. For this photo, what I see is that sometimes ships will catch fire, then your ship will go over and see what's going on, right?

ZY: Yes, this is an aquatic fire drill. Well, everyone knows that there are often accidents on water, where some boats carrying some chemicals or combustibles could catch fire. It's difficult for us to know the actual situation at the scene, we can use an unmanned boat to get closer to the fire and conduct an investigation in the area, so that the firefighters don't have to go and the rescue missions would be safer. After we obtain information about the scene, we will decide how to carry out this firefighting and other related work as well.

JL: Look, this is another photo, this is an oil rig. Oil drilling is conducted away from the shore. Do you also send a boat to survey the environment?

ZY: Well, for the use of this ship on the offshore drilling platforms, usually there may be several people on the platform all year round, or even a dozen people. But these people, the platform may be about 50 to 60 meters above sea level, super high. Above the sea, there are only the few of them. Delivering necessities such as tools and food supplies could be difficult, because it's impossible to only rely on helicopters.

So our small boat is mainly used to transport the materials to them. It will go back and forth between these drilling platforms every day. Once it's at the platform, there is a crane that picks it up. It's pretty much like express delivery.

JL: I understand. Yunfei, I want to change the topic a bit. I heard that at Yunzhou, there are several hundreds of employees, but to produce so much output with only a few hundred people is actually not easy. I heard that in the last 10 years, you have already produced about 1,000 to 2,000 ships.

ZY: Well, we have produced more than 1,000 ships this year alone.

JL: 1,000 units in one year! It's not easy at all. And there are such big ships over the size of 50 tons, isn't it?

ZY: Right. This year, there's been a big improvement in the market. Our sales this year should be 5 times that of last year.

JL: That's not easy at all.

ZY: Yes, because like what you said, this product is really brand new. No one has used it before, and our company size and output rank first in the world now. So in the beginning, you need to communicate with the market and the customers for a long time. Only when everyone understands this product will there be a demand for purchase. So generally speaking, it was last year or this year that the market began to grow.

JL: This is your Dolphin, one of the two that the Dean of Engineering just tested at HKUST.

ZY: Yes, yes.

JL: This is a very good concept. Looking back, when you made this boat for the first time which took 3 years, how was it like then? Did a client come up to you and tell you "I have this requirement", or did you just do it out of interest and then identify a suitable client? A lot of entrepreneurs and aspiring students have this question as well. Even if I'm interested in the area, the market may not have such a demand.

I know you, like me, graduated from the School of Engineering. How did you get your "market sense"? Did you have a partner to help you? Or did you test the market, manage research, and the financial matters all by yourself? Were you really a one-man band? How was it when you first started?

ZY: Well, when we first started, we were all engineering students, with no marketing or other majors, so everyone was in technology. But before we officially started the company, we still had this kind of idea.

At first, it was completely based off our interests in making such a small boat, and then we started investigating whether we could measure water parameters. We didn't understand market needs at that time, and then after making this small prototype, we participated in many entrepreneurship competitions, like some entrepreneurship competitions in Hong Kong. In the process, we slowly developed some concepts, that is, if you want to start a business, you need to gauge the demand for the product, market positioning, so on and so forth.

After that, before we actually started our business, we spent a year doing market research. Whether everyone was interested and if we could actually start a business. But often, as science and engineering students, we make the mistake of wanting to design a product with very powerful functions, according to our own wishes. But, after developing it, we find that the market does not necessarily need it. In a way, Yunzhou is special. Our small team realized that we didn't understand the market, so we said, let's not start a business yet. Let's do a year of market research, and if we discover that this is feasible, then we go ahead and start a business.

27:48

So, starting from 2009, we went to a lot of places, from Yunnan, Sichuan, to Guangxi, Hunan, Jiangsu, Zhejiang, Beijing, these dozens or so provinces and cities, and went to the local environmental protection department to find out whether they needed products like an unmanned ship to measure pollution. We described what we could do for them, to first find out whether they needed it. Secondly, if they do need it, what kind of functions do they expect? And thirdly, find out how much they are willing to pay for this kind of thing.

After such a year of research, we found that the result is very positive, that is, everyone wanted this product. At the same time, after hearing everyone's requirements for the product's functions, we started to have a concept for the first-generation product, so we sat down and discussed it. There is a certain market for this. We think we can start a business, so we formally established the company to do business.

JL: Yunfei, we have a lot of entrepreneurial viewers right now. I'm curious whether all these classmates were from HKUST, or were they from other places?

ZY: At the earliest stage, there were 4 of us, all from HKUST.

JL: So I can confidently say that this is indeed, a 100% HKUST unicorn. Is that right? Can I say that?

ZY: Yes, it's completely HKUST-made.

JL: That's brilliant. That's exactly my experience as well. If I knew earlier, I would have asked to be born 10 years later so that I could start a business with you.

ZY: Don't say that.

JL: Yunfei, when you first started this 100% HKUST unicorn, where did your first funding come from at that time? Did you ask your family, your mother and father? Or did you, like other people, find VCs or win prizes in entrepreneurship competitions? When you were first starting out, how was it during the most difficult time?

ZY: Actually before we started in 2010, we had a year when we earned prize money from entrepreneurship competitions. At that time, the money from the entrepreneurship competitions added up to hundreds of thousands of dollars, which allowed us to conduct principle research in school. Then while we started the business, up until 2013, we didn't know what VC was. We had no idea what investment was.

Then when we started the business, we thought to pool together our money. We all took out some money ourselves, and it added up to 1 million, and then I asked my mother to borrow 1 million. So in the earliest three years, our fund was this approximate 1 million, which includes prize money from the competition along with the money from each of us.

JL: That's really not easy. Then we have to thank auntie, that is, your mother, for supporting this HKUST business. If we ever award a prize to you guys, we also need to award it to your mother. It'd be perfect if you asked your mother to study at HKUST such that this really is a 100% HKUST-alumni start-up.

ZY: After we established the company, in Zhuhai, there are a lot of schemes to support international student start-ups. So, in the first or second year of the business, we were granted more than 1 million government funds. All in all, in our first 3 years of business, before we formally raised funds, we probably had a total of about 4 million of funds comprised from these groups.

JL: This isn't easy. I think you have a certain endurance and confidence to conduct a year of research before starting a business and to understand your own shortcomings. I believe this is already halfway to success.

So what plans do you have for the future? Now that you have reached this stage, becoming the world leader of unmanned ships, what is your next step? Do you want to make a bigger ship, or make more boats, or do you have any other thoughts?

ZY: From a technical point of view, in the past 10 years, we've been trying to get a feel for it, continuously feeling, learning and thinking, as an unmanned system on the water, what kind of ability should we provide and how can it serve our societal needs in the future. In general, in the past few years, for robotic unmanned systems on water, the general development has been a process of technological evolution, from mechanical automation to informatization and intelligence. In fact, it is very similar to much of the development on land, including driverless cars and so on.

Then, specifically, in terms of its model of application, it's gone from a single platform, for example, for an unmanned boat, it has gradually batched cluster operations, even to cross-media and cross-domain operations, connecting to unmanned systems in the air, unmanned systems on water surface, unmanned systems underwater, even unmanned systems on the road. This is the type of technological evolution that is going on. So for us in Yunzhou, in terms of technological innovation, we must invest in a new area in the long run.

On one hand, we will focus on its core technology. This means its perception, to allow them to see more accurately, and in the domain of motion control, to allow it to run more accurately from this place. At the same time, for unmanned systems in different industries, whether it is marine scientific research or in the environment, its mode of operation. We will also pay attention to whether the clustered job is heterogeneous and cross-domain or what kind of mode. In the process, many new technologies are needed, such as communication technology, sensor technology, the technology of the material used for support.

JL: Actually, Yunfei, now I started to understand. So in the beginning, you made boats one after another, one by one. Now, you are designing by the concept of a fleet, like an aircraft carrier team, which is not only for ships, but also for aerial and underwater. I heard that, when I was speaking with you just now, that there's a system called Intelligent Mobile Ocean Stereo Operation System (IMOSOS). Does it carry the same implication?

ZY: Yes, I think I can use this project as a way to introduce the future development of unmanned system technology.

35:24

From this picture, we can see that our system is called IMOSOS. It includes this mothership, which is this larger boat on the left, about 2,000 tons and 90 meters long. This mothership itself has more than 50 unmanned systems mounted on it, including our unmanned aerial vehicles, with fixed-wing, suspenseful, and trickle, as well as the unmanned surface vehicles, there are diesel-powered, wave-powered and solar-powered ones. For underwater, there are smart profile buoys, which can make observations from surface to underwater, and also the underwater AOV sliding airplane. The system spans about 100 kilometers in diameter, 4 kilometers into the air, and 4 kilometers into the water surface, covering a 3D area in the sea, to make a large-scale, comprehensive and simultaneous observation from multiple nodes. This means that our acquisition of ocean information is becoming more refined.

If we need meter-level resolution of data, then we must rely on packing more nodes in the area, such that dozens of nodes are able to simultaneously obtain data so that we can reproduce an ocean phenomenon to learn how it evolves. For example, if an ocean physicist is observing the formation of a small vortex, then we can see, how does the atmosphere change? How does the temperature, humidity, and water-air interface change? How does the velocity, temperature, and salinity change in this underwater vortex? We must synchronize this system through the network. Only after getting these data can we reconstruct a three-dimensional structure of it.

We couldn't do this in the past, because we used to rely on only one ship to measure one particular point. Now, using this unmanned system, you can get 100 points of data at the same time. 70% of our planet is covered by the ocean. Various weather changes and energy conversions are actually closely related to the ocean. The movement of the ocean brings all kinds of things, so to understand the ocean in a more refined way would be helpful towards our understanding of this world, of its climate, natural disasters, etc.

So here, there are many key technological issues that need to be solved. For example, for every unmanned boat and unmanned system, whether it has the ability and its own smaller sensors to collect more accurate data, and also the capability of the unmanned systems in creating a network, integrating air communication and underwater communication. We also need to solve the problem of cooperating the formation of a system of unmanned system. Then, we still have to solve the problem of how a large mother ship can transport it, ship it out on the sea, release them in batches, collect them after work etc. under different sea conditions, like strong wind and waves at times.

We have to solve so many problems, so many technical difficulties, but we believe that this kind of clustered unmanned system operation will be a very important direction of application in the future. Why? I'll give a simple example: we have a scientific research boat that may cost about 5 to 10 hundred million, which is about 100 million U.S. dollars. It can collect data at sea, but if you break down its capabilities into a small unmanned system, you may only need 0.1% of that cost to produce 50% of the initial output. Then with 50 unmanned systems, the overall operating efficiency can be increased by more than 10 times, while the cost will be reduced by 10 times. So this will be an important direction for development and application in the future.

JL: You are completely right, Yunfei. In fact, the ocean covers most of the Earth's surface, and frankly speaking, I don't think humans have sufficient knowledge of the ocean. So, if you can really produce what you are thinking of doing, then our understanding of the ocean will be deepened. But from a technical point of view, this will also not be easy. From what you just said, especially when I know a little bit of communication, in terms of communication, it will be very challenging research indeed. Also, this is a field that no one has ever done before, can I say that?

ZY: Yes, I think so. I think even 10 years ago, this was impossible to be done, because it relies on the advancement of many basic technologies, such as the computing power of this chip, how to produce smaller sensors with lower cost, etc., so it is only at this time that we may be able to do this.

This year, we have achieved some phased progress. For example, last month, we did a test of these 10 unmanned boats simultaneously doing such an observational task of ocean surveying and mapping, which is like having broken down this large task into several steps that are already being carried out. Our entire project will be fully completed and put into use in about 2022.

JL: Yunfei, I especially admire your foresight. Also, I know you gifted two Dolphin-1s to HKUST last time. You value education, and encourage HKUST and its students. You said that you are going to make this software public, open for students to study. In this aspect, aside from the industry side, it seems like you have your own opinions on education or education on software development.

ZY: Yes. While I was at school, I mostly followed my interests and hobbies to do these things, to start a business slowly. I always think that hobbies and interests are very important especially while studying. I think, in hindsight, HKUST and Shenzhen Experimental School, my middle school had the greatest influences on me. In a way, these two schools gave students a lot of space, allowing students to use the school platform and facilities to develop their hobbies.

This year, we also upgraded our Dolphin 1. The two at school still requires remote control, that is, if someone falls into the water, we need to use the remote control to drive it to around the person. But after we upgrade today, we will have a CCTV by the water, which can cover 500 meters of water surface, so if someone falls into the water within this range, we can automatically recognize it through the image that someone fell into the water. Dolphin 1 will have a release mechanism. So when someone falls into the water, it will push Dolphin 1 into the water, and then use this image navigation to automatically guide the boat to the person who fell into the water. That way, no matter whether it is day or night, even if there is no one on duty at the water's edge, rescue can be carried out.

After this upgrade, I think this project is actually a very good one, just like FYDP, right, with the image recognition technology, the next step could be to dive a little deeper to find out how to distinguish swimmers, and people who are drowning, yeah? In addition, it also includes recognition at night, which may have to do with image processing. It also has a visual navigation, that is, we don't have the GPS coordinates of the person who fell into the water, so we have to use the vision system to guide the Dolphin 1 to the drowning person's position. Of course, we can also use positioning, such as transformation. You can let everyone think contemplate, how to go about such a task? What kind of technology can make it better? I think this can open up such an opportunity to everyone. Those who are interested can go to these two systems to develop your own algorithms and come up with your own ideas. This is a very meaningful thing.

44:28

JL: I think, for the students of HKUST, this is a really interesting project. Because at HKUST, even the Dean, he likes AI, big data, vision recognition, development of hardware and software. Also, mentioning about your Wanshan International Intelligent Vessel Competition, I think this is also part of overall layout and concepts. I believe you are simultaneously developing both education and your company, right?

ZY: Yes, this year, our company developed a platform strategy, which is the development strategy of our next 5 years. This platform strategy can be elaborated on using this shared picture. This is something we developed over the past 10 years. This is Auto Vehicle Operating System (AVOS), a boat-operated system, is similar to this ROS, but it is a smart boat designed specifically for the surface. We started from the bottom and went up step by step. It's a system with a distributed architecture, which we will open it up to scientific research institutions and universities along with our distributed hardware, so this is an industrial strategy. Also, we will propose an innovation strategy.

What is the innovation strategy? Mainly for universities and other scientific research institutions, including our own. We hope to establish 10 scholarships in 10 universities by this year, so we can allow students interested in smart technology on water to have opportunities to delve into this aspect, including supporting scientific research, social outreach, for example, taking up internships at these big companies, and supporting some to participate in competitions, so this is the first thing.

Secondly, we host the Wanshan International Intelligent Vessel Competition annually. This year, just last month, we finished the first competition. Unfortunately, because of the pandemic, only the University of Macau was able to come to Zhuhai to participate in the competition. All overseas universities, including HKUST, couldn't come. So we only had 10 Mainland universities and the University of Macau to compete in the first-ever competition.

In the competition, we only tested algorithms, so Yunzhou provided a unified platform for this unmanned boat. Everyone used the same, unified hardware. We set up 5 different subjects, including, for example, rescue of those who fall into the water, collision avoidance on this voyage, etc.

The competition ran for about a week. The result was very exciting. Students usually have a lot of theoretical accumulation in schools, including the design of control algorithms, but they may not have such a platform for them to put this knowledge into practice. In the course of this competition, some teams came into Zhuhai for debugging 2 months in advance, and then return to their school to conduct remote debugging, because we can debug remotely via the Internet. After a long time of preparation for debugging, in the final competition, most of the students completed our designed subjects. This made us very surprised, because we thought that most subjects might be the first trial, and not easy to accomplish, but the result was very good.

JL: This is really meaningful. It's a pity that we couldn't participate because of the pandemic. But next time, we will definitely send a team from our school to participate, or we hope that you will do this in Clearwater Bay. This kind of competition give us more chances to participate in this project.

Yunfei, you've been working until you're so successful now, so what do you actually think? You have been making ships, since the beginning in 2006 at HKUST, working as a certain unmanned ship, to this extent. Will you sometimes look back and say that if I knew this then, I would have done things differently, or if I knew this back then, I would've spent more time preparing? I see you're very busy, but did you look back over the past 10 years of entrepreneurship, that I should've done a little better at that time, or maybe I needn't have done so well?

For example, do you ever think you didn't have to do so well in exams?

ZY: I'm still thinking of an answer to such a direct question. It is my character that I quickly forget about previous difficulties, or areas where I did well. Someone once asked me what is the most difficult thing about your 10 years in the industry? I could no longer recall. Or maybe, what makes you particularly successful? I also can't think of anything. I think this is a form of self-protection, because sometimes you just need a restart.

Well, I'm particularly invested whenever I do something, so in the process of working, I will put a lot of pressure on myself. But I'm also the type of person to be able to quickly relieve pressure. I've always said that there's nothing you can't be solved by supper, that's to say, if I've had a challenging day, I might eat supper that night. This is the ritual, and I feel like everything's all right after that. I will go to sleep and face these problems again the next day.

That's why looking back at these years, there isn't anything in particular that I regret, anything I did particularly well or bad. I think we've developed very smoothly. In a way, this is something that requires a lot of investment. It's a very complicated system. Besides, we need long-term research and development before launching a product used on the ocean. Our general R&D cycles consist of more than five years.

It should be said that the past 10 years and more than 10 billion has been spent, have been invested in the research and development of this matter. It's very lucky, so I don't think there is any regret. The only regret would be because of my habit of eating supper, which has caused me to gain too much weight.

JL: Yunfei, you said it, not me!

51:40

Yunfei, let me ask you. You have a lot of juniors watching our fireside chat. Do you have any special advice for the students who are studying now, who hope to succeed in their business?

ZY: Well, this is a very good question, I can talk more about this question. I think it is divided into several pieces.

One is before starting a business. While everyone is still at school learning and studying, you may already have some ideas about starting a business in the future. At this stage, I think what's important is for everyone to have a "T-shaped" thinking. T has two strokes, one horizontal and one vertical, right?

So what is this horizontal line? This line is that we want to expand our skills horizontally, which is our skillset, it can't just be a single professional technology. We still need to think about the future development of this technology, in terms of the market, finance, etc. We need to expand our skill boundaries so that we can be better. Because in the beginning, we don't have a very luxurious line-up or many professionals, we can only rely on our start-up partners, and everyone has to be well-rounded. This horizontal stroke represents the need to expand some of their own skills. At the same time, there is also a vertical stroke.

What is this vertical stroke? It's not necessarily the depth of professional understanding. It should be the accumulation of the industry, and it is necessary to delve into this industry. I think you have to judge whether you can start a business before starting. One very important point is to find out, have you studied the industry deeply enough? Maybe there are technical problems, business problems, environmental problems, etc., which we must solve it. Only if you are an expert in the industry you want to engage in in the future, could you be in this industry, establish your position, or your competitive position, or make your first product.

So I think our HKUST students must be very skilled in technology.

But you still need to work on developing skills and understanding of the industry, so that they may be able to deal with future problems, especially the difficulties faced in the early stage of entrepreneurship. The beginning is really very difficult, 99 out of 100 may be unsuccessful, so we must expand our horizontal and vertical skillsets to improve our chances of success.

JL: Yunfei, I completely agree. I remember, and I'm not kidding, when I came to Zhuhai to see you a few years ago, I think that although you were already very successful, you were still concerned about every aspect of everything. You paid attention to every detail and you had to manage manpower, technology, the market, and the finances. Actually, you must be very invested in your company and the industry to do so, otherwise you wouldn't have succeeded. Looking back, you came to Hong Kong in 2013, 2014, no, 2006. It's been about 10, 15 years, including your initial ideas. This concept of producing an unmanned ship, the first seed of this idea has grown in your mind for about 20 years to achieve today's success. It surely isn't easy.

Also, there are some students who would like to ask, we collected some emails of what students wanted to ask, he said: I very much hope that I can start a business relationship with Yunzhou, to work in the big family of Yunzhou. What do you consider when evaluating whether this person or this student is suitable to work in Yunzhou? Whether they should not start a business at all, but just do other things. What do you look for in terms of personality? Any special opinions?

Your start-up is so successful, while there is still keen competition in this industry as compared with other industries. You may have different considerations when you are in the industry. Then will you tell these students, "Hey, come to Yunzhou"? Or, "hey, don't come here"? Will you have such an opinion?

ZY: I think the main idea behind this question is the issue of career planning. For Yunzhou, we actually have various positions that may require students of different qualities, so you could not say that whether a certain classmate is suitable or not. But I think each of our students should have a vision for their future career development.

For example, my personality is, particularly aggressive. For example, in risk management, there are different levels of risks, and I'm not too afraid of risks. I'm very willing to challenge them. I'm willing to put in 16 hours a day just to make one thing happen. Maybe then he is more capable in overcoming the early stage of entrepreneurship.

But some students have a particularly stable personality. He's very serious, but he also hopes to have a more balanced life. Each person may play a different role, in a company like Yunzhou or even in other companies, it's all the same. Our talents all have different roles.

There are innovators, right? He needs to create a breakthrough in some work, and may need a certain personality. For some others who are our intermediate strengths or core strengths, they may need the ability of endurance. There are also some people who may be willing to do some detail-oriented work.

So in a relatively large company, people with different characteristics can often find a position suitable for them. We need to have a clear career path plan, so that we can find what we want to do. Of course, it doesn't matter when we are young, because we can try more and see if it's suitable for us. If not, we can try again. Being young is the biggest advantage. At Yunzhou, we very much welcome HKUST students if you are interested. Right now, even though we're already 10 years old, our demand for talents is still comprehensive.

We still need entrepreneurial partners, because we still have many challenging industries to open up, and work needs to be done, whether be it R&D or business operations. At the same time, we also have more typical operating institutions that also need very professional and technical colleagues to engage in these professional jobs. So in fact, talents from all aspects will be very welcome.

59:30

JL: So we have a QR code on this picture if you're interested to join Yunzhou on its development journey. Looking at this 90-meter ship, if I was younger, I think it'd be quite enjoyable doing experiments at sea. So you can just scan this QR code.

A few final questions. Yunfei, you really are one of the most enthusiastic people that I've seen. But normally, aside from work and the occasional eating, what do you like doing most? People need to relax, but every time I see you, you're working, and every time we talk, you talk about these ships.

I see that you don't play basketball anymore, right?

ZY: I started playing last week. I played a match last week, and it lasted almost 2 hours. It's very meaningful. I went to play last week. I told my friends that the last time I played, I weighed 150 pounds, and now it's 230 pounds, but I am still playing with the same techniques I used when I was 150 pounds. So it's quite difficult still jumping to the hoop, right?

JL: Is it more difficult to shoot hoops?

ZY: You've pictured it in your mind, but your body is unable to do it.

JL: Ok. Apart from basketball, which you just started two weeks ago, what else do you do? For example, any books to read, any movies to watch, or any hobbies you would like to recommend to other students?

ZY: Actually, I don't have a very healthy lifestyle. My biggest pastime is just watching movies. Of course, because of the pandemic, I've watched much fewer movies. I used to see the last showing at 11pm quite often.

Actually even when I was at HKUST, I often went to Hang Hau to watch movies, because our HKUST student ID card gives a discount.

JL: Really?

ZY: Yes. Sometimes I sneak out to Hang Hau after 10 o'clock in the evening to watch a movie. So my biggest relaxation now is going to the movies, and when you go to the movies at 11 o'clock in the evening, the whole theatre is yours. There is only you in the entire movie theatre.

I personally like Marvel very much, like Iron Man, Transformers. Maybe all guys may be into these themes, so I've actually included a lot of these elements in our products. This is my main and only pastime now. The

individual ones are a bit extravagant. Actually, I used to like photography very much. I waited for so many things. Now, I haven't continued with it.

Besides, in fact, I also have a field that I'm very interested in, which is to promote the exchange of youth in the Greater Bay Area. Because I'm also an All-China Youth Federation Committee member, and I also established some social posts. I went to school in Shenzhen and studied in Hong Kong, and I also started a business in Zhuhai. I've been moving around the Greater Bay Area, so I'm particularly interested and hope to be able to set up some opportunities for young friends in the Bay Area to move around more and have more exchanges and opportunities for cooperation.

So starting this year, we've been doing a lot of development in this area, including for various age groups. Such as the competition I just mentioned, we've many universities in Guangdong, Hong Kong and Macau participating. There will also be a football technology summer camp for middle school students in Macau and Zhuhai at the end of this month. We'll be turning our current base into one for youth science education. We'll regularly hold this popular science training for some teenagers. For example, if elementary school students are interested, they'll come to us for a day of class on weekend. We'll do some exploration on early AI models and then provide some small ship models and go for a run in the water.

So now I'm particularly interested in this type of work, and I also hope to have the opportunity to talk more with our alma mater, to promote the work of popular science.

JL: That's great, Yunfei, I'm just very touched, that besides liking your career, you also have a strong sense of social responsibility. I think it seems like the talents cultivated by HKUST are getting better and better! So I think it's about time.

So once again, Yunfei, thank you for your precious time. I hope that next time we won't need to chat via video conferencing, I hope I can come and live with you for a day or two in Zhuhai next time, to chat and play basketball, although it probably won't be much of a game. If it's a movie, I can watch it with you too. Thank you, Yunfei. I hope your career will be smooth sailing, and enjoy the rest of the week.

Thank you, Yunfei.

ZY: Thank you.

JL: Goodbye.