Collaboration Agreement

# Parties of the Agreement

1. Lead partner of project (on the Czech side) Name: VÚTS, a.s.

Domicile: Svárovská 619, 460 01 Liberec XI., Czech Republic National ID of company: 46709002

Represented by: prof. Ing. Miroslav Václavík, CSc. (Further more as “VÚTS”)

1. Partner of project (on the Czech side)

Name: AMF REECE CR, s.r.o.

Domicile: Tovární 837/9c, Prostějov 798 11, Czech Republic

National ID of company: 46709002 Represented by: Ing. Igor Komloš

(Further more as “AMF REECE”)

1. Partner of project (on the Czech side)

Name: Západočeská univerzita v Plzni, Regionální technologický institut

(RTI)Domicile: Univerzitní 2732/8, 301 00, Plzeň, Czech Republic National ID of company: 49777513

Represented by: doc. Ing. Luděk Hynčík, Ph.D., Vice-Rector for Research and

Development

(Further more as “ZČU ”)

and

1. Lead partner of project (on the Taiwanese side) Name: TomLong Techstile Corp.

Domicile: No. 5, Gong 6th Rd., Dajia Dist., Taichung City 437106, Taiwan (R.O.C.) National ID of company: 510402726

Represented by: Vincent Wu (Further more as “TTC”)

1. Partner of project (on the Taiwanese side) Name: Shape It Corporation

Domicile: 7F., No. 299, Gaotie 1st Rd., Wuri Dist., Taichung City 414010, Taiwan (R.O.C.)

National IDD of company: 521003033 Represented by: Kathy Wang

(Further more as “SIC”)

1. Partner of project (on the Taiwanese side)

Name: Taiwan Textile Research Institute

Domicile: Chnegtien Rd., No. 6, 23674 New Taipei City - Tucheng Dist., Tchaj- wan (Taiwan)

National IDD of company: 304804475

Represented by: Prof. Kuei-Chi Lee, Ph.D. - president (Further more as “TTRI”)

All partners Together as “Partners” or “Parties”

Partners 1,2, 3: Together as “Czech Partners” Partners 4, 5, 6: Together as “Taiwanese Partners”)

# Preamble

1. Partners have considerable experience in the field of machine design and textile technologies.
2. Partners expressed interest in common implementation of the project called “Production technology performance increase and distance fabrics utility properties extension for new applications".

(hereinafter referred to as “Project”).

1. Partners submitted together common project proposal for the 2nd public call of the DELTA 2 programme of the Technology Agency of the Czech Republic (hereinafter referred to as

„TACR“) and the Ministry of Economic Affairs, Taiwan (hereinafter referred to as „MoEA“). TA CR-MoEA Bilateral Co-funding R&D Project.

1. The submitted project proposals were approved by both grant agencies (by TA CR and MoEA).
2. Partners will finance their project costs with funding from national financing schemes.
3. Czech Partners have received a subsidy from TA CR for the eligible costs of the project under the registration number TM02000031.
4. Taiwanese Partners have received a subsidy from MoEA for the eligible costs of the project under the registration number 110-EC-17-A-25-I9-0002.
5. Partners acknowledge importance of the project and therefore they declare strong determination to finish the Research project. Partners acknowledge that the premature termination of the agreement may cause significant loss to all Parties.

# Purpose of the agreement

1) The purpose of this Collaboration Agreement is to specify with respect to the Project the relationship among the Parties, in particular concerning the organisation of the work among the Parties, the management of the Project and the rights and obligations of the Parties concerning inter alia liability, Access Rights and dispute resolution.

# Subject of the agreement

1. The overall objective of the project is innovation and development of distance fabrics technology production and its further treatment. The implementation will be primarily focused on increase of productivity and extension of utility properties of developed technology and its comforted implementation into real operation. The main project output will be a prototype of air-jet weaving machine DIFA 2, through which this innovative technology for the distance fabrics production will be implemented.
2. The subject of the implementation, goals and outputs are described in Attachment Nr. 1 “Project description”.
3. Involvement of individual Partners, their role in the project and outputs are described in the Attachment Nr. 2 “Roles of each Lead Organization and Participating Organization, Time schedule”.
4. Financing of the project activities is secured by each Partner as stated in the Attachment Nr. 3 “Financing plan”.

# Duration of Collaboration Agreement

1. This Collaboration Agreement is valid for a definite period of time, until the full fulfilment of all obligations of all project partners arising from this agreement, but no later than 365 days from the date of completion of the project period 1.1.2021 – 31.12.2023.
2. The Collaboration Agreement may be terminated unilaterally for serious reasons with the obligation to compensate all justified costs and losses to the other Partners, except in cases where Collaboration agreement is terminated due to a material breach of the Collaboration Agreement by another Party.

# Right and duties of Parties

1. Parties are obliged to proceed activities described in Attachment Nr. 1 “Project description”.
2. VÚTS is responsible for communication with grant agency TAČR.
3. TomLong Techstile Corp. is responsible for communication with grant agency MoEA.
4. Parties are obliged to participate on project meetings of project partners.
5. Parties are obliged to inform regularly other project partners about progress in the project tasks, achievements, possible delays, risks and other matters important for project implementation.
6. Each of Parties is responsible for carrying out the activities within the planned time schedule and for controlling conformity with the time schedule. In case of deviation from the time schedule VÚTS is obliged to inform the other Parties arties immediately and prepare a new time schedule in cooperation with the other Parties. The Attachment Nr. 2 “Roles of each Lead Organization and Participating Organization, Time schedule” gives the basic time schedule.
7. Lead Partners VÚTS and TTC have right to require information and data necessary for execution of project activities from all Partners.
8. All Parties are obliged to cooperate with Lead partners in any possible inspection by public bodies, especially by grant agencies.
9. Parties are obliged to ensure the financing of their activities in the amount and structure, see Attachment Nr. 3 “Financing Plan”.
10. Parties have the right to share information needed to implement the project, while being obliged to follow the provisions set out in points VII., VIII. and IX.

# Results, Intellectual property rights, access rights

1. “Results“ means any (tangible or intangible) output of the research and development such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the Project, as well as any rights attached to it, including intellectual property rights.
2. Results are owned by the Party that generates them. Two or more Parties own Results jointly if they have jointly generated them. The co-ownership share of the Result is determined by the ratio of the Parties' creative contributions to achieving the Result.
3. Each Party will be obliged to ensure exclusive right to dispose of all intellectual property rights associated with the Results and to protect them in accordance with relevant legal regulation If

this party is not interested in protecting these rights, it is obliged to offer the transfer of such Result to the other Parties.

1. The Parties undertake to inform each other on filing applications of inventions, utility models and industrial designs at the Industrial Property Office or at foreign patent offices incurred in connection with the implementation of the project.
2. Intellectual property rights to jointly owned Results shall be registered for protection with an indication of the ownership shares of the Parties. The Parties will share the costs associated with the application, archiving and maintenance of the industrial property rights (“IPR”) in the amount according to their co-ownership share. Also the price of any sale of a license to a third party will be divided in the same proportion.
3. The Parties are entitled to use their intellectual property originated prior to the commencement of the project without limits. The attachment Nr. 4 “Pre-existent knowledge” defines majority, but not all, of the intellectual property of the Partners originated prior to the commencement of the Project.
4. The Parties will be responsible for the infringement of rights of third parties concerning industrial or other intellectual property resulting from the use of their protected principles in the proposed solutions.
5. The Parties grant each other rights to use (Access Rights) — on a royalty-free basis — the Pre- existent knowledge and the Results to implement the Project only. Any Access Rights granted expressly exclude any rights to sublicense unless expressly stated otherwise.
6. Access Rights to Results or to Pre-existent knowledge, if needed for exploitation of a Party's own Results, shall be granted on fair and reasonable conditions.

# Additional regulations

1. The Party may use the Results owned by another Party only on the basis of a written license agreement, which sets out the conditions for such use, incl. financial or nonfinancial compensation.
2. The joint owners must agree (in writing) on the terms of exercise of their joint ownership (joint ownership agreement). The joint ownership agreement shall specify conditions for the use of the jointly owned Result by one of the co-owners and conditions for the further commercialisation of the jointly owned Results. None of the Partners is entitled to use the jointly owned Result without such agreement. License agreements with third parties relating the jointly owned Result shall be concluded by all co-owners of the Result.

# Non-disclosure

1. The Partners shall be mutually obligated to maintain confidentiality in relation to confidential information, in particular, but not limited to, technical, commercial and personal data of the other Partner and not to pass such information on to third parties.
2. The Party shall use all information of the other Parties that is classified as confidential exclusively for the project, shall keep it confidential and shall not provide it to third parties without the prior written consent of the relevant Partner during the project and for a period of five (5) years after the end of the project.
3. The Partners shall apply the same degree of care with regard to the confidential Information disclosed within the scope of the project as with its own confidential and/or proprietary information, but in no case less than reasonable care.

# Liability

1. No Party shall be responsible to any other Party for any indirect or consequential loss or similar damage such as, but not limited to, loss of profit, loss of revenue or loss of contracts, provided such damage was not caused by a willful act or gross negligence.
2. Each Party shall be solely liable for any loss, damage or injury to third parties resulting from the performance of the said Party’s obligations by it or on its behalf under this Collaboration Agreement or from its use of results or background.
3. In respect of any information or materials (incl. results and background) supplied by one Party to another under the Project, no warranty or representation of any kind is made, given or implied as to the sufficiency or fitness for purpose nor as to the absence of any infringement of any proprietary rights of third parties.

# Miscellaneous

1. No Party shall be entitled to act or to make legally binding declarations on behalf of any other Party. Nothing in this Collaboration Agreement shall be deemed to constitute a joint venture, agency, partnership, interest grouping or any other kind of formal business grouping or entity between the Parties.
2. No rights or obligations of the Parties arising from this Collaboration Agreement may be assigned or transferred, in whole or in part, to any third party without the other Parties’ prior formal approval.
3. This Collaboration Agreement is drawn up in English, which language shall govern all documents, notices, meetings, arbitral proceedings and processes relative thereto.
4. The Parties shall endeavor to settle their disputes amicably. All disputes arising out of or in connection with this Collaboration Agreement, which cannot be or have not been solved amicably, shall be finally settled by the competent court of Czech Republic.
5. This Collaboration Agreement shall be construed in accordance with and governed by the laws of the Czech Republic excluding its conflict of law provisions.

# Severability clause

1. If any provision of this Collaboration Agreement becomes ineffective or unenforceable, the applicability of the other provisions shall not be affected.
2. The Parties to the Collaboration Agreement agree to replace any ineffective provision immediately with a provision that comes closest to the purpose of the ineffective provision and the purpose of the portions of the Collaboration Agreement.

# Written form

1) Supplementary oral agreements to this Collaboration Agreement have not been concluded. Additions and amendments to this Collaboration Agreement must be made in writing in order to be valid. Waiver of the requirement for written form must also be made in writing.

# List of attachments

1. Project description
2. Roles of each Lead Organization and Participating Organization, Time schedule
3. Financing Plan
4. Pre-existent knowledge

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

VÚTS, a.s.

…………………………………………. ……………………………………….

VÚTS, a.s. Date, Location

prof. Ing. Miroslav Václavík, CSc. CEO

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

AMF REECE CR, s.r.o.

…………………………………………. ……………………………………….

AMF REECE CR, s.r.o. Date, Location

Ing. Igor Komloš Managing director

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

Západočeská univerzita v Plzni, Regionální technologický institut

…………………………………………. ……………………………………….

Západočeská univerzita v Plzni, Date, Location

Regionální technologický institut (RTI) doc. Ing. Luděk Hynčík, Ph.D.,

Vice-Rector for Research and Development

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

TomLong Techstile Corp.

…………………………………………. ……………………………………….

TomLong Techstile Corp. Date, Location

Vincent Wu CEO

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

Shape It Corporation

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Shape It Corporation Date, Location

Kathy Wang CEO

### Signature sheet of Collaboration Agreement about project implementation “Production technology performance increase and distance fabrics utility properties extension for new applications" of partners:

VÚTS, a.s., AMF REECE CR, s.r.o., Západočeská univerzita v Plzni, Regionální technologický institut (RTI),TomLong Techstile Corp., Shape It Corporation, Taiwan Textile Research Institute

Taiwan Textile Research Institute

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Taiwan Textile Research Institute Date, Location Prof. Kuei-Chi Lee, Ph.D.

President

Attachment Nr. 1

Project Description

The topic of the propose follows on an already solved project called *“R&D technology of industrial production of distance fabrics high and variable distances on an air-jet weaving machine”*, in which the technology was developed within international cooperation of R&D organizations VÚTS, a.s. and South Asian TTRI (Taiwan Textile Research Institute).

This solution represents the world's unique technology, which allows automatic distance fabric production from high-tenacity fibres while ensuring structural properties and high quality of the fabric, moreover with the possibility of a fluently adjusted distance of fabric during the weaving process.

The overall objective of the project is another innovation and development of distance fabrics technology production and its further treatment. The solution will be primarily focus on increase of productivity and extension of utility properties of developed technology and its comforted implementation into real operation. The main project output will be the prototype of air-jet weaving machine DIFA 2, through which this innovated technology for the distance fabrics production will be realized.

Within this project, the works will be focused on:

O INCREASE THE WEAVING REED WIDTH

* The current reed width maximum of air-jet weaving machine DIFA is 2 200 mm (distance fabric width 1 800 mm). One of the aims is focused on maximum reed width 2 300 mm (distance fabric width 2 000 mm).

O INCREASE THE PERFORMANCE

* Increase the weaving speed (RPM) and time shortening for the cycle of loop creation.

O FOCUS ON THE RANGE OF FABRIC DISTANCES LOWER THAN 12 CM

* One of the aims is focused on the wider range, specifically on distance decrease from current 12 cm to target value at least 10cm or smaller.

O NEW PATTERNDESIGNER SOFTWARE APPLICATION BY VÚTS, A.S.

* CAD software development for pattern design (geometrical and structural parameters) of distance fabric high, constant or variable distances, which further allow conversion design of distance fabric structure to pattern program form applied into weaving machine control system and primarily into electronic rotary dobby as a shedding and sampling device implemented to the system of weaving distance fabric high and variable distances on air-jet weaving machine DIFA 2. A part of the software will be warp ends drawing-in design into the weaving reed and shafts.
* SEWING THE RAW DISTANCE FABRIC
* Due to large-batch re-wounding during the next (final) treatment, the layers of distance fabrics begin to move relative to each other. This fact is unacceptable for the final treatment technological process – the moving of the layers makes impossible the coating. The stitches eliminate the layers moving and sewing process fixes them together.
* COATING TECHNOLOGY ON DROP STITCH FABRIC
* During the drop-stitch product coating process, it is required to coat upper-layer and then lower- layer. Due to the thickness of drop stitch fabric and pile density, flatness of fabric is very difficult to control in coating process. Even tension of fabric will be changed while coating two different layers. Tension control has been a crucial problem and it also affects flatness of fabric. Following works are thought to be essential:
* Improve drop stitch coating flatness
* Using double-side coating technology to avoid tension problem of upper-layer and lower-layer.
* Improve tension control system and rewinding and unwinding system.
* LIGHTWEIGHT TECHNOLOGY ON DROP STITCH FABRIC FOR SUP
* SUP (Stand-up Paddle) is a famous water sport in the world. It was estimated that the average annual growth rate of the global SUP market will reach 11.9% from 2018 to 2028; it is confirmed that it will become a popular sea sports in the world. The weight of SUP is between 7.5 kg to 13 kg, excluding pumping equipment. Whenever going for SUP, we need to carry more than 13kg of SUP equipment, which is rather heavy and strenuous. Thus, making a lightweight SUP product has become our major challenge.
* Develop the lightest SUP product in the world
* Using TPU/PP yarn weave drop stitch to replace PET yarn.
* By deploying multiple ovens and godet rolls to improve strength of TPU/PP yarn.
* INCREASE YARN STRENGTH ON DROP STITCH FABRIC
* Drop stitch fabric can be used in rescue and emergency scenarios, like earthquake, building collapse, and heavy-duty accident. Even it also can be used to load heavy items in marine transportation. Polyester is not strong enough to be used in these situations. It is needed to produce a much stronger yarn like UPE. UPE, known as UHMPE (Ultra High Molecular Weight Polyethylene), is the strongest yarn in the world. Although it is very strong, there are some drawbacks to use UPE such as low melting point and low coefficient of friction. Low coefficient of friction means hard to weave, whereas low melting point creates some difficulty in welding process. It is aimed to resolve these problems and produce a high loading and high strength drop stitch product.
* Develop high loading and high strength drop stitch by using UPE yarn weave drop stitch
* By applying surface modification of UPE yarn to improve bonding strength.
* By applying UPE yarn coating technology to Improve the difficulty of weaving.

The presumed project outputs on the Czech side are:

O THE PROTOTYPE OF AIR-JET WEAVING MACHINE (VÚTS)

O THE PROTOTYPE OF SEWING DEVICE (VÚTS | AMF REECE | ZČU RTI)

O UTILITY MODEL OF SEWING DEVICE (AMF REECE | VÚTS)

O PUBLICATION (VÚTS | ZČU RTI)

O OTHERS - PATTERNDESIGNER SOFTWARE APPLICATION (VÚTS)

The presumed project outputs on the Taiwanese side are:

O THE PROTOTYPE OF DOUBLE-SIDE COATING DROP STITCH FABRIC (TOMLONG|SHAPEIT|TTRI)

O THE PROTOTYPE OF LIGHTWEIGHT SUP FABRIC (TOMLONG|SHAPEIT|TTRI)

O THE PROTOTYPE OF HIGH STRENGTH DROP STITCH FABRIC (TOMLONG|SHAPEIT|TTRI)

O PUBLICAION (TOMLONG|SHAPEIT|TTRI)

Attachment Nr. 2

## Roles of each Lead Organization and Participating Organization, Time schedule

### VÚTS, a. s.

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| Task no | Task Name | Description | Results | Period |
| 1. | The prototypeof air-jet weaving machine DIFA 2 | It will be realized 3D CAD design of functional groups of weaving machine and machine as a whole, documented by basic calculations and computer’s simulations.Subsequently, it will be created production-design documentation. The prototype of air-jet weaving machine DIFA 2 will be produced, assembled and revived according to this documentation and the DIFA 2 machine will be prepared for experimental testing. | The research reports (calculations, simulations). 3D CAD development data – documentation. Drawing design documentation. Technological production documentation. Produced and revived the prototype of air-jet weaving machine DIFA 2. | 1.1.2021 – 31.12.2022 |
| 2. | The weaving tests | The experimental functionality testing, control system parameters adjusting. The distance fabric samples production. | The functional prototype of air-jet weaving machine DIFA 2 with reached goal parameters. Distance fabric samples. | 1.10.2021 – 31.12.2023 |
| 3. | PatternDesigner | It will be programmed user-friendly software application “PatternDesigner” that will facilitate the structural design of distance fabrics and their following transfer and the entering to pattern device of the DIFA 2 machine. | PatternDesigner software application. | 1.1.2021 – 31.12.2023 |
| 4. | Sewing system of distance fabrics | The realization of production of load-bearing frame structures of the sewing system of distance fabrics. The implementation of the designed system into space demands of the prototype air-jet weaving machineDIFA 2. It will be verified the design solution functionality by experimental adjusting and testing. | The tuned prototype of sewing system of distance fabrics on weaving machine. The distance fabrics stitched samples. | 1.1.2021 – 21.12.2023 |

AMF Reece

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| Task no | Task Name | Description | Results | Period |
| 5. | Sewing device | It will be realized sewing unit design, processed production design documentation. According to this documentation will be produced a functional model of a sewing unit. It will be realized experimental adjusting and testing designed solution functionality and possible verification. | 3D CAD development data – documentation.Drawing design documentation.Technological production documentation.The functional model of sewing unit. | 1.1.2021 – 31.12.2021 |
| 6. | Sewing system of distance fabrics | It will be realized multiplication of sewing unit. The realization of whole system production. Subsequently, the sewing system will be implemented into space demands of the prototype of air-jet weaving machine DIFA 2. It will be verified designed system functionality as a whole by experimental adjusting and testing. | The tuned prototype of sewing system of distance fabrics on weaving machine. Distance fabrics stitched samples. | 1.1.2022 – 31.12.2023 |

Západočeská univerzita v Plzni - RTI

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| Task no | Task Name | Description | Results | Period |
| 7. | Sewing system of distance fabrics | It will be realized the design of load-bearing frame structures of the sewing system of distance fabrics on the weaving machine. It will be realized computer simulations of the dynamic behaviour of the construction and its optimization. The models will be verified based on experimental measuring on the prototypeof the air-jet weaving machine DIFA 2. | The research reports.3D CAD development data – documentation.The experimental measuring protocols. | 1.1.2021 – 1.6.2023 |
| 8. | The prototype of air- jet weaving machine DIFA 2 | Based on input analysis and experimental measuring behaviour of current state distance mechanism will be designed its dynamic simulation model – FEM by which it will be performed optimization of complex rigidity of mechanism transport beam. The simulation model will be checked and verified based on experimental measuring. Further, will be performed computer simulation of key’s functional-technological configuration of distance mechanism. | Research reports. Simulation models – FEM.3D CAD development data – documentation.Experimental measure protocols. | 1.1.2021 – 31.12.2023 |

Tomlong

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| Task no | Task Name | Description | Results | Period |
| 9. | Coating Technology on Drop Stitch Fabric | 1. Improve drop stitch coating flatness
2. Using double-side coating technology to avoid tension problem of upper-layer and down-layer.
3. Improve tension control system and rewinding and unwinding system.
 | 1. Double coated drop stitch fabrics with low distance
2. Develop tension control system and rewinding and unwinding system
 | From January 1, 2021 to December31, 2021 |
| 10. | Lightweight Technology on Drop Stitch Fabric for SUP | 1. Develop the lightest SUP product in the world
2. Using TPU/PP yarn weave drop stitch to replace PET yarn.
3. By deploying multiple ovens and godet rolls to Improve strength of TPU/PP yarn
 | 1.Lightweight SUP products 2.Composition formula of TPU/PP yarn | From January 1, 2022 to December31, 2022 |
| 11. | Increase yarn strength on Drop Stitch Fabric | 1. Develop high loading and high strength drop stitch by Using UPE yarn weave drop stitch
2. By applying surface modification of UPE yarn to improve bonding strength.
3. By applying UPE yarn coating technology to Improve the difficulty of weaving
 | 1. Flexible and high loading and high strength drop stitch fabric
2. Tecnique for surface modification of UPE
 | From January 1, 2023 to December31, 2023 |

ShapeIt

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| Task no | Task Name | Description | Results | Period |
| 12. | Drop Stitch Fabric Pattern Design | 1.Use 70D and 250D PET yarn to weave drop stitch fabric. 2.Use 150D PET yarn for pile design.1. Pile height ≤ 15cm
2. SUP product design
 | 1. Pattern design VS different yarn count
2. SUP product weight ≤ 7.5kg 3.Welding strength ≥ 5kg/inch 4.Inflation pressure ≥ 1.2 bar 5.Weight capacity ≥ 120kg
 | From January 1, 2021 to December31, 2021 |
| 13. | Lightweight Drop Stitch Product | 1. Develop the lightest SUP product in the world.
2. Develop welding process for using TPU/PP drop stitch fabric.
 | 1.Lightweight SUP product 2.Pattern design | From January 1, 2022 to December31, 2022 |

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|  |  | 3.Pattern design for lightest SUP | 3.Welding technique |  |
| 14. | High Loading and High Strength Drop Stitch Product | 1. Pattern design and pile density VS Load-bearing strength, tearing strength and burst strength.
2. Pile height design VS buoyancy.
3. Develop low temperature welding process. 4.Blowhole design VS max inflation pressure 5.Make lift bag product.
 | 1. The relationship between fabric structure and strength.
2. Lift bag product design
3. Low temperature welding technique
 | From January 1, 2023 to December31, 2023 |

### TTRI

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| Task no | Task Name | Description | Results | Period |
| 15. | Spin two components of TPU/PP yarn | Parameter setup on development of two components of TPU/PP yarn on a solution based spinning system in a lab scale. | Yarn products and research reports on finding the optimum conditions for two components TPU/PP yarn design | From January 1, 2021 to December31, 2021 |
| 16. | Develop low distance fabric | Develop low distance fabric (< 12 cm) by sample loom, find the key parameter machine setup, and provide the sample fabric for coating process. | Low distance fabrics made by sample loom.Research and test reports of weaving parameters for low distance fabric | From January 1, 2022 to December31, 2022 |
| 17. | Develop low distance fabric to vary pile density | Based on the present DIFA air jet weaving machine at TTRI, it is aimed to develop different pile density of low distance fabrics, find key parameter setup, and provide fabric samples for coating process in a lab scale. | Fabric samples for different pile density.Research and test reports of weaving parameters for different pile density of fabrics. | From January 1, 2023 to December31, 2023 |
| 18. | Optimize coating process control technology | Analyse coating parameters and influencing factors by experimental design to establish the relationship between thickness and strength, to facilitate the quality control. | Research reports for low distance fabric coating parameter design and optimum conditions. | From January 1, 2021 to December31, 2021 |
| 19. | Wind up tension control technology on coated distance fabric | Wind up tension analysis after distance fabric casting or coating to set up suitable tension control system, to improve wind-up folding. | Research reports for distance coated fabric tension control system | From January 1, 2021 to December31, 2021 |

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| 20. | Investigate the physical properties of high and low distance composite fabric | Collect the benchmark coated fabrics from the market, and a series of study will be conducted at TTRI to compare the performance of novel coated fabrics with that of the existing fabrics in the market. | Research and test reports with regard to the comparison of high and low distance fabric physical properties | From January 1, 2023 to December31, 2023 |