Dual Degree Agreement

between

Institut Polytechnique des Sciences Avancées (IPSA)
7-9 Rue Maurice Grandcoing,
Ivry-sur-Seine 94200, FRANCE

and

The University of Arizona
Department of Aerospace & Mechanical Engineering
1130 N. Mountain Avenue,
Tucson AZ 85721, USA

The aim of this agreement is to specify the terms under which students from IPSA may be granted, upon successful fulfillment of the program and of all requirements for graduation at each institution, the academic degrees and diplomas of comparable academic levels from both institutions.

The agreement was concluded in the following terms:

i. Outline of the dual degree program

IPSA students who have passed the IPSA pre-selection process and have successfully completed the fourth year and first semester of the fifth year of the five-year Engineering Diploma (recognized as Master level 1 by the CTI and French Ministry of Education) are eligible for direct entry to the second year (Spring & Summer semesters) of the University of Arizona MS in Aerospace & Mechanical Engineering (AME).

IPSA students who have completed the prerequisites for entry to the University of Arizona Masters program and have successfully completed the required credit units and thesis at the University of Arizona will be awarded the IPSA Engineering Diploma and the MS in Aerospace & Mechanical Engineering from the University of Arizona.

ii. Selection

Students will be selected each year for the double degree program based on official final transcripts of the completed fourth year IPSA program (total 60 ECTS credits), their motivation and English level (Applicants must submit a minimum TOEFL (Test of English as a Foreign Language) score of 79 internet based (iBT), 550 paper based (PB), or IELTS (International English Language Testing System) composite score of 7). Students will be selected by IPSA and applications sent to the University of Arizona each year by the 10th of October. Final admission of students is always at the discretion of the University of Arizona.

iii. Credit transfer end evaluation

To be awarded the **University of Arizona MS in Aerospace & Mechanical Engineering (AME)** students must complete a total of **32 Credits** (see article v). The University of Arizona AME department will accept **between 9 and 12 course credit units** from IPSA's fifth year curriculum upon review by the curricular committee of the participating departments (see annexes i-ii). Only courses with grades of A or B will be accepted as transfer.

To be awarded the **IPSA Engineering Diploma**, students must transfer the equivalent of at least 22 ECTS credits (see article v) from courses taken at the University of Arizona. The course credits to be transferred should be decided on an individual basis at the start of the semester and validated by the academic coordinator of IPSA. Students are also expected to have completed 28 weeks internship, of which 14 weeks must be conducted in a company before, during or after their period of studies at the University of Arizona.

iv. Standard length of study

The estimated length of study at the University of Arizona is 12 months.

v. The dual degree schema

	4th year	5th year AUTUMN Semester at IPSA October-December	5th year SPRING Semester at UA January-May	6th year AUTUMN Semester at UA August-December	TOTAL REQUIRED CREDITS
MS in Aerospace & Mechanical Engineering (AME)		Equivalent of up to 12 UA credits (d) to be transferred to UA. Including (e) Local (compulsory) version of AME500A (3 UAC) & AME 696G (1 UAC)	Validation of minimum 12 UA credits (c) Including (e) AME 500B (3UAC) AME 910: Thesis (3UAC)	Validation of remaining UA credits (b) Including (e) AME 910 Thesis (3UC)	**AME: 32 UA credit hours**
IPSA Engineering Diploma	Validation of 60 ECTS credits (a)	Validation of minimum 22 ECTS credits (d)	Validation of minimum 22 ECTS credits (c)	Internship rapport 12 ECTS credits (a)	**IPSA : 120 ECTS**

Notes:

(a) IPSA credits which will count only for the IPSA diploma
(b) UA credits which will count only for the UA degree
(c) UA credits which will be double counted
(d) IPSA credits which will be double-counted
(e) for more corresponding courses see annexes

vi. Extension and interruption

In case the study abroad program is partially incomplete the students will be allowed to extend their stay at the host university. Any necessary extension will be subject to the payment of tuition fees.
Each institution has the right to interrupt the double degree program in case of unsatisfactory academic results. The student will then have to return to IPSA where the accumulated credits will be transferred in order to allow him/her to solely achieve the IPSA diploma.

vii. Number of students

The number of students to be admitted for the coming academic year under this agreement is estimated at three (3) but may at any time be negotiated by the responsible authorities at both institutions, prior to the deadline for submitting student applications for the coming academic year to the host institution.

viii. Tuition fees, other costs

Students are expected to pay all required fees directly to the University of Arizona, including tuition fees for the duration of the program (nominally 2 semesters) and a compulsory health insurance. Qualified students may be eligible for a tuition and fee reduction, if hired as Graduate Research Assistants during their studies at the University of Arizona. Students will themselves be responsible for all arrangements for visa and accommodation, on or off campus, with the help and advice of the International Office of the host institution.

ix. Student obligations

During their stay at the host institution, students will be subject to all internal rules of the host university and to all legislative and social obligations of the host country.

x. Academic and administrative contacts for the program:

For the University of Arizona:

- Academic Coordinator: Dr Eniko Enikov, Associate Professor

e-mail: enikov@email.arizona.edu Tel. +1 .520.621.4506
- Administrative coordinator: Nancy Preble
e-mail : npreble@email.arizona.edu Tel. +1.520.626.8741

For IPSA:
- Academic Coordinator: Dr. Karim Trabelsi, Research Professor
E-mail: karim.trabelsi@polytechnique.edu
- Administrative coordinator: Gabriella Torino, Head of International Relations
E-mail: torino@ipsa.fr Tel. +33. 1.56.20.62.78

xi. Duration

This Agreement covers a period of five years from the date of its signing.

xii. Applicable Law

As to activities taking place in Arizona and as to claims against Arizona Law, this Agreement will be governed and interpreted by the laws of the State of Arizona, United States of America. As to activities taking place in France and as to claims against IPSA, this Agreement will be governed and interpreted by the laws of France.

xiii. Dispute Settlement

a. The Parties will make a good faith endeavor to settle amicably, through direct negotiations between them, any dispute, difference, controversy or claim ("Dispute") arising under, out of or relating to this Agreement and any subsequent amendments of this Agreement, including, without limitation, its formation, validity, binding effect, interpretation, performance, breach or termination, as well as non-contractual claims.
b. Failing amicable settlement of any Dispute within thirty (30) days from the day the Dispute arose, at the request of either party, within a reasonable time period, any dispute, controversy, or claim arising out of or relating to this contract, or the breach, termination, or invalidity thereof, shall be settled by arbitration in accordance with the jurisdictional organ of each place as follows: (a) As to activities taking Domestic place in France and as to claims against IPSA the arbitration shall take place in France according to the laws of France, as the governing law; (b) As to activities taking place in Arizona and as to claims against Arizona Law, the arbitration shall take place in the State of Arizona, United States of America, according to the laws of Arizona as the governing law, and in accordance with the Revised Uniform Arbitration Act, A.R.S §12-3001*et seq.* (the "Act"), whose rules shall govern the interpretation, enforcement, and proceedings; (c) The number of arbitrators shall be three, including the chair; (d) The language to be used in the arbitral proceedings shall be English if conducted in Arizona and French if conducted in France; and (e) The Parties agree that the decision of the arbitrators shall be final and binding upon them.

xiv. Arizona State Agency Provisions

a. The Parties acknowledge that performance by The Arizona Board of Regents for and on behalf of the University of Arizona may be limited by the failure of the legislature of the State of Arizona to appropriate adequate funds for such performance, or if the University of Arizona's appropriation is reduced during the fiscal year, then it may reduce the scope of this Agreement if appropriate or cancel it without obligation. Arizona Law agrees to notify IPSA law as soon as reasonably possible after the unavailability of said funds comes to its attention.
b. Either Party may cancel this Agreement if any person significantly involved in negotiating, drafting, securing or obtaining this Agreement for or on behalf of one Party becomes an employee in any capacity of the other Party.
c. Arizona Law is bound by applicable United States state and federal rules governing Equal Employment Opportunity and Non-Discrimination. The Parties agree that participation by Arizona Law personnel or students in any activities relating to this Agreement shall not be denied to any individual on the basis of race, color, religion, national origin, age, non-disqualifying handicapping condition, veteran status, or sex.
d. Neither Party's officers, agents nor employees shall be considered officers, agents or employees of the other Party or be entitled to receive any employment-related fringe benefits, including tuition reduction, fee waivers or other fringe benefits from the other Party.
e. Neither Party shall be responsible in any way for any misrepresentation, negligent act or omission, breach of contract, or willful misconduct of the other party, its officers, directors, agents, or employees, in connection with the performance of any obligation under this Agreement.

f. Nothing herein shall be deemed to constitute or create a relationship of agency, joint venture or partnership among the Parties and no Party hereto shall have any power or authority to act for or bind the other Party.
g. This Agreement constitutes the entire agreement and understanding of the Parties with respect to its subject matter. No prior or contemporaneous agreement or understanding will be effective. The provisions of this Agreement may be amended or modified only by mutual written agreement by each Party's authorized contracting officers.
h. The Parties agree that no person or entity is intended to be a third-party beneficiary of this Agreement.
i. No Party will use the trademarks, trade name, trade dress, or other commercial property of any other Party hereto without the express written approval of that Party.
j. The Parties have a legitimate educational interest in student records of Program students.

xv.

The obligations for IPSA under this agreement are subject to the laws, rules or regulations applicable to the academic program in France. IPSA is absolved from all liabilities if due to any change in the laws or rules or regulations or if due to any conditions or restrictions/prohibitions introduced by the regulatory authorities IPSA has to alter/modify or discontinue the Program. The Parties acknowledge that performance by IPSA's Administrative Authorities for and on behalf of IPSA may be limited by the failure of the legislature of the French or local government to appropriate adequate funds for such performance, or if IPSA's appropriation is reduced during the fiscal year, then it may reduce the scope of this Agreement if appropriate or cancel it without obligation. IPSA agrees to notify Arizona law as soon as reasonably possible after the unavailability of said funds comes to its attention.

Signed on behalf of the University of Arizona

.....
Dr. Andrew Carnie
Dean, Graduate College

Dated: May 27/2013

Signed on behalf of IPSA
Institut Polytechnique des Sciences Avancées'

Le Directeur Général
.....
Mr Hervé Renaudeau
Managing Director of IPSA

Dated: 28/6/2013

Annexes

1. **Concerning Transferable credits**

All MS in Aerospace Engineering students are required to complete Advanced Engineering Analysis (500A and 500B) and 2 units of Graduate Seminar (AME 696G). IPSA may provide the module AME 500A and AME 696G in the first semester of the fifth year, the contents of the module to be agreed between the Mathematics department of IPSA and the AME department of the University of Arizona. In order to receive graduate credit, students must earn at least a B in 500A and 500B.

Additional courses to AMA 500A and 696G to be transferred may include IPSA equivalents of AME 558, AME 536A, AME561 and AME564A. These courses will allow the completion of Dynamics and Control, MEMS option, and Thermal Sciences focus areas. IPSA may propose additional fifth-year courses in order to facilitate the completion of Solids and Fluids programs out of sequence.

2. **Possible IPSA courses transferable to the Master of Aeronautical engineering at the University of Arizona (for a maximum of 12 UA credit units transferred)**

IPSA COURSES	UNIVERSITY OF ARIZONA EQUIVALENT	
Compulsory local version of AME 500A (M. Trabelsi) Vector calculus, linear algebra; ordinary differential equations, calculus of variations.	**AME 500A : Advanced engineering analysis I (COMPULSORY)** Vector calculus, linear algebra; ordinary differential equations, calculus of variations	**3UAC**
Refresher course of local units Au 54 : System identification, Au 55 : Observers and Kalman Filters and Au 58 : Non-linear control systems (M. Sellami) -Modelling and control (linear/non-linear systems, continuous / discrete time, deterministic / stochastic, controllability / observability, stability, pole placement, integral controller, full order observer). -Nonparametric identification, parametric identification, Kalman Filter, Extended Kalman filter, Unscented Kalman Filters, stability of nonlinear systems, phase plane analysis, overview of nonlinear control systems, sliding mode control.	**AME 558 Advanced Modern Control Theory of Mechanical Systems** State space representation of linear systems; topics include controllability, observability, stability, full state feedback, reduced order feedback, pole placement, optimal regulators, optimal observers.	**3UAC**
Mé 54A : Calcul des Structures par la MEF (M. Larbi) Finite Element Analysis : Application to design Aeronautic/Aerospace structures -Callback of the finite element method (Weak formulations, element calculations, Gauss integration and applying boundary conditions, static and dynamic problems, Eigenvalue problem) -Design of the structure -Identification and application of boundary conditions -Definition and application of materials -Analytic verifications of the elasticity matrices for composites materials (matrices A, B and D) -Dynamic analysis of the structure in transient domain: comparison between direct approach and reduced order model approach -Dynamic analysis in frequency domain: identification of dominant modes -Damping treatment for vibration attenuation.	**AME 561 Finite Element Methods** Matrix methods for solving boundary value problems in structural mechanics and fluid mechanics, heat and mass transport, isoparametric elements, Galerkin methods, solution schemes, convergence criteria, condensation and diagonalization methods. Development of new finite elements for computer projects and presentations.	**3 UAC**
M2 54B : Calcul Numérique en Aérodynamique (M. Lé) Numerical techniques for the aerodynamic analysis of Aerospace structures, -Callback of the Fluid Dynamics -Fluid properties in the atmosphere. -Conservation equations.	**AME 536A Fundamentals of Fluid Mechanics** Fundamental equations of motions; surface tension; kinematics of vorticity; integral solutions; irratational flows;	**3 UAC**

-Incompressible inviscid flow; superposition of simple flows, source distribution technique; panel method, computation of pressure distribution around an airfoil. -Incompressible viscous boundary layer around the airfoil and computation of skin-friction drag. Laminar, transitional, and turbulent boundary layer. -Wing geometry and aerodynamic coefficients. -Two-dimensional thin airfoil theory; flat plate and cambered airfoils, incompressible flow around wing of finite span; unswept and swept wings; vortex lattice methods, delta wings. -Aerodynamics of projectiles, ground vehicles, and buildings.	simple viscous flows.	
Participation Tuesday conferences (minimum number to be decided)	**AME 696G (1 UAC)**	1 UAC

3. University of Arizona AME modules available for double degree students from IPSA in the Spring/Fall semester

UA course code	Subject	UA credits	ECTS credits
AME 910	**Spring/Summer - THESIS (COMPULSORY)** A 6 UA Credit thesis to be selected with the approval of the faculty advisor and IPSA.	6	12
AME 500B	**Spring - Advanced Engineering Analysis II** (COMPULSORY) *Complex variables, partial differential equations, eigen function expansions and transform methods.*	3	6
AME 696G	**Spring - Graduate Seminar (COMPULSORY)** *The development and exchange of scholarly information.*	1	2
AME 589A :	**Micro technology**	3	6
AME 553 :	**Computational Multi-body Dynamics** *Computational methods in spatial multibody dynamics; Euler parameters; automatic generation and numerical methods in solving equations of motion; application in vehicle dynamics, spacecraft, and robotics.*	3	6
AME 586 589A	**Micro electromechanical systems (MEMS)**	3	6
AME 522	**Aerospace Engineering Design** *Application of engineering fundamentals, including structural analysis, structural vibrations, aero-elasticity and finite element methods to aerospace vehicle design project.*	3	6
AME 586	**Microfluidics** *Fundamentals of micro scale fluid mechanics: size effects; fabrication and diagnostic techniques for micro fluidic systems; pressure-driven gas flows in micro systems; electro kinetically-driven liquid flows in micro systems; micro polar liquid flows.*	3	6
AME 588	**Micro and Nano Transducer Physics and Design** *Principles, design, and performance of micro and nano transducers. Designing MEMS to be produced with both foundry and nonfoundry processes. Applications of unique properties of micro and nano transducers for biological and engineering problems. Associated signal processing requirements for these applications. Graduate-level requirements include review and presentation on one of the following topics: AFM, Confocal Microscopy, FTIR, NSOM, Multi-photon Microscopy, SEM, SICM, STM, TEM, Ultrasound, and XPS. Undergraduate students can choose to design and analyze a MEMS device as term project.*	3	6
AME 589A	**Fabrication Techniques for Micro- and Nanodevices**	3	6

	techniques for the design, fabrication, and testing of traditional microelectromechanical systems (MEMS) and nanodevices.		
AME 583	**Micro Biomechanics** *Thermodynamics, mechanics, and structures of biomolecules (e.g., proteins and DNA) and cells. Deformation mechanisms and theories for both flexible and semi-rigid chains, and the applications in biomolecules and cells. Experimental micro biomechanics techniques for both biomolecules and cells.*		
A ME 575	**Reliability Testing** *Chi-square, student t and F distributions; mean-time-between-failure and reliability confidence limits for continuous and one-shot systems; tests of comparison of the mean life; Gamma and Beta distributions; goodness-of-fit-tests; sequential testing; sampling; accelerated, sudden-death, suspended-items, non-parametric, and Bayesian testing, and test sample size determination.*	3	6
A ME 549	**Hybrid Control Systems** *An introduction to hybrid control systems. Topics: modeling; solutions; Zeno behavior; stability; convergence; robustness; control design. Applications: unmanned aerial vehicles; robotic manipulators; hard-disk drive; mechanical systems with impacts; impulsively-coupled oscillators; cellular networks.*	3	6
A ME 520	**Aircraft Conceptual Design** *Methodology for the preliminary sizing of an airplane to a given mission specification will be presented. Design issues include configuration, aerodynamics, weights, and performance.*	3	6
AME 528	**Space Mission Conceptual Design** *Introduction to space mission design and modern tools available to aid the designer, such as FoM and LCC.*	3	6