

Aircraft Design

Papers Presented at the AIAA Aviation Forum 2020

Online
15 - 19 June 2020

ISBN: 978-1-7138-1719-2

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwytkug'Xcmg{'Ftkxg.'Uwky'422, Reston, VA 20191, USA.

TABLE OF CONTENTS

AIRCRAFT SYSTEMS ENGINEERING & DESIGN CASE STUDIES I

DESIGN CASE OF THE E-19 AEOLUS SUPERSONIC BUSINESS JET.....	N/A
<i>Howard Smith, Yicheng Sun</i>	
FEASIBILITY ASSESSMENT OF ELECTRIC TOW PLANE CONCEPTS	N/A
<i>Ugo Martinez, Jonathan C. Gladin, Dimitri Mavris</i>	
DESIGN TOOLS FOR CONCEPTUAL ANALYSIS OF FUTURE COMMERCIAL SUPERSONIC AIRCRAFT	1
<i>Mohammed Hassan, Holger Pfaender, Dimitri Mavris</i>	
SAFETY CONSTRAINED MULTI-UAV TIME COORDINATION: A BI-LEVEL CONTROL FRAMEWORK IN GPS DENIED ENVIRONMENT.....	N/A
<i>Wenbin Wan, Hunmin Kim, Yikun Cheng, Naira Hovakimyan, Petros G. Voulgaris, Lui Sha</i>	
THE AIR-VEHICLE AS A COMPLEX SYSTEM OF AIR TRANSPORT ENERGY SYSTEMS	24
<i>Daniel Silberhorn, Johannes Hartmann, Niclas M. Dzikus, Georgi Atanasov, Thomas Zill, Urte Brand, Juan C. Gomez Trillos, Matthias Oswald, Thomas Vogt, Dennis Wilken, Wolfgang Grimme</i>	

AIRCRAFT CONCEPT DESIGN TOOLS AND PROCESSES I

AERODYNAMIC CHARACTERISTICS OF AN INNOVATIVE LARGE TURBOPROP THROUGH WIND TUNNEL TESTS INCLUDING PROPULSIVE EFFECTS	49
<i>Fabrizio Nicolosi, Salvatore Corcione, Danilo Ciliberti, Vincenzo Cusati</i>	
PERFORMANCE AND COST ADVANTAGES OF AIRCRAFT COMPRISED OF MISSION- OPTIMIZED AEROSHELLS ON UNIVERSAL FUSELAGE CORES.....	66
<i>Steve A. Brandt, Danesh M. Bam, Josiah R. Bierle, Tia M. Massa, Adam T. Munkata</i>	
EFFECTS OF DISTRIBUTED PROPULSION ON WING MASS IN AIRCRAFT CONCEPTUAL DESIGN	93
<i>Anais Luisa Habermann</i>	
CONCEPTUAL AIRCRAFT STRUCTURAL DESIGN IN AN UNDERGRADUATE CAPSTONE COURSE.....	110
<i>Matthew Snyder, Hugh C. Briggs, Steve A. Brandt, Spence Chanthavane, Benjamin Pagel</i>	

COMPLETE AIRCRAFT DESIGN I

AIRCRAFT CONCEPTUAL DESIGN OF COMMUTER AIRCRAFT INCLUDING DISTRIBUTED ELECTRIC PROPULSION	124
<i>Francesco Orefice, Fabrizio Nicolosi, Pierluigi Della Vecchia, Danilo Ciliberti</i>	
MULTIDISCIPLINARY OPTIMIZATION OF A NEXT-GENERATION NARROW BODY TRANSPORT.....	142
<i>Paulo E. Vasconcelos, Yau-Fung Lam, Anthony Allen, Elijah Rivera, Timothy T. Takahashi</i>	

CONTINUED DESIGN AND DEVELOPMENT OF A TORNADO INTERCEPT UNMANNED AERIAL VEHICLE	170
<i>Andrew L. Ross, Jamey D. Jacob, Andrew S. Arena</i>	
CONFIGURATION-INDEPENDENT INITIAL SIZING METHOD FOR UAM/EVTOL VEHICLES.....	183
<i>Rodra W. Hascaryo, Jason M. Merret</i>	
EFFECTIVENESS ENHANCEMENT OF MEDIUM CALIBER MUNITIONS FOR AERIAL COMBAT	199
<i>Lauren Schumacher, Ronald M. Barrett</i>	

AIRCRAFT CONCEPT DESIGN TOOLS AND PROCESSES II

DESIGN OF A DISTRIBUTED PROPULSION CONCEPT USING AN ADJOINT-BASED APPROACH AND BLADE ELEMENT THEORY TO MINIMIZE POWER	208
<i>Irian Ordaz, Eric J. Nielsen, Li Wang</i>	
TAIL SIZING CONSIDERATIONS FOR WINGTIP PROPULSOR DRIVEN AIRCRAFT APPLIED TO THE PARALLEL ELECTRIC-GAS ARCHITECTURE WITH SYNERGISTIC UTILIZATION SCHEME (PEGASUS) CONCEPT	225
<i>Nathaniel J. Blaesser, Zachary J. Frederick</i>	
MINIMIZING INDUCED DRAG OF RECTANGULAR, ADDITIVELY MANUFACTURED WINGS.....	241
<i>Justin D. Valenti, Michael Yukish</i>	
CONCEPTUAL DESIGN OF LOW-BOOM LOW-DRAG SUPERSONIC TRANSPORTS.....	253
<i>Yicheng Sun, Howard Smith, Haixin Chen</i>	

AIRCRAFT PERFORMANCE METHODS, TOOLS AND PROCESSES

AIRCRAFT SHOULD NOT BE FAIR WEATHER FRIENDS – IMPACT OF WINDS ALOFT ON AIRCRAFT OPERATING ECONOMICS.....	264
<i>Philip R. Thomas, Timothy T. Takahashi</i>	
HOW TO SOAR ABOVE THE COMPETITION – DESIGN STRATEGIES TO IMPROVE AIRLINER OPERATING ECONOMICS IN REAL WEATHER.....	285
<i>Philip R. Thomas, Timothy T. Takahashi</i>	
NOISE, EMISSIONS AND COSTS TRADE FACTORS FOR REGIONAL JET PLATFORMS USING A NEW SOFTWARE FOR AIRCRAFT PRELIMINARY DESIGN	303
<i>Fabrizio Nicolosi, Pierluigi Della Vecchia, Vittorio Trifari, Mario Di Stasio, Francesco Marulo, Agostino De Marco, Valerio Marciello, Vincenzo Cusati</i>	
FLIGHT-STATES AND CONTROL INPUTS COMPUTATION USING NONLINEAR PROGRAMMING FOR UNMANNED AIR VEHICLE	324
<i>Qazi M. Salahudden, Vijay Shankar Dwivedi, Ajoy Kanti Ghosh</i>	
THE ANALYSES OF AIRCRAFT PERFORMANCE DURING TAKEOFF AND LANDING WITH AERODYNAMIC INTERFERENCE EFFECTS AND THE 6-DOF MODEL	332
<i>Sukru A. Erturk, Fazil S. Gomec</i>	

DIFFERENTIAL DYNAMIC PROGRAMMING TO CRITICAL-ENGINE-INOPERATIVE TAKEOFF CERTIFICATION ANALYSIS	358
<i>Jiacheng Xie, Evan D. Harrison, Dimitri Mavris</i>	

AIRCRAFT CONCEPT DESIGN, TOOLS AND PROCESSES III

INLET DIFFUSOR BUOYANCY - AN OVERLOOKED TERM IN THE THRUST EQUATION.....	373
<i>Timothy T. Takahashi, Spencer Cleary</i>	
AN APPROACH FOR FAN STAGE CONCEPTUAL DESIGN WITH NON-AXISYMMETRIC STATORS IN PRESENCE OF DISTORTION	396
<i>Manish Pokhrel, Jonathan Gladin, Russell K. Denney, Dimitri Mavris</i>	
PREDICTION OF THE OPERATIONAL ENVELOPE OF ELECTRIC AIRCRAFT THROUGH ROBUST BATTERY CYCLE-LIFE MODELING	N/A
<i>Matthew A. Clarke, Juan J. Alonso</i>	
INFLUENCE OF AILERON PLACEMENT ON ROLL RESPONSE OF HIGH-ASPECT-RATIO-WING AIRCRAFT	419
<i>Divya Sanghi, Cristina Riso, Carlos Cesnik, Fabio Vetrano</i>	
MAINSTREAM FLOW PREDICTION FOR THE THERMAL RISK ASSESSMENT OF AIRCRAFT SYSTEMS IN CONCEPTUAL DESIGN	435
<i>Florian Sanchez, Abdul Malik Huzaiifa, Susan Liscouet-Hanke</i>	
A CONCEPTUAL DESIGN TOOL TO SUPPORT HIGH-SPEED VEHICLE DESIGN	455
<i>Davide Ferretto, Roberta Fusaro, Nicole Viola</i>	
SIMULATION DRIVEN DESIGN WORKFLOW FOR AIRCRAFT GEARBOX.....	477
<i>Dhiren Marjadi, Youn Park, Dragi Gasevski, Marlow Springer, Milos Stanic, Viraj Kulkarni</i>	

AIRCRAFT DESIGN CASE STUDIES II

THE EFFECT OF MANUFACTURING VARIATION ON AERODYNAMIC PERFORMANCE AND FLIGHT SAFETY	494
<i>Timothy T. Takahashi, Ruben E. Perez</i>	
THE IMPACT OF A NEW MID-RANGE AIRCRAFT WITH ADVANCED TECHNOLOGIES ON AIR TRAFFIC EMISSIONS AND CLIMATE.....	508
<i>Florian Linke, Katrin Dahlmann, Berit Gerlinger, Sebastian Woehler, Tom Otten, Martin Plohr, Felix Presto, Johannes Hartmann, Marco Weiss</i>	
DYNAMIC SIMULATION OF VEHICLE MANEUVERS FOR LOADS ANALYSIS	522
<i>Xiao Jing, Benjamin Berthon, Luke A. Somers, Geoffrey Rairigh, James Morgan, Darshan Sarojini, Evan D. Harrison, Dimitri Mavris</i>	
LESSONS LEARNED FROM THE DESIGN, MANUFACTURING, AND TEST OF AN ALL-ELECTRIC GENERAL AVIATION AIRCRAFT	532
<i>Vincent Boulanger, Antoine Gaillardetz, Laurent Chiasson Poirier, Kevin Guimond, François Lachance, Etienne Raby, David Rancourt</i>	

METHODS AND METAMODELS FOR PRELIMINARY DESIGN - WEIGHT

STRUCTURAL WEIGHT PREDICTION FOR AN URBAN AIR MOBILITY CONCEPT	549
<i>Tyler F. Winter, Joe H. Robinson, Mark Sutton, Julius Chua, Armando Gamez, Thomas Nascenzi</i>	
DESIGN AND VALIDATION OF BUCKLING DOMINATED WING STRUCTURE FOR SMALL UNMANNED AERIAL SYSTEMS	561
<i>Nikolay Kolesov, Timothy T. Takahashi</i>	
TOWARD STRUCTURAL MODELLING STRATEGIES FOR CHARACTERIZATION OF FUTURE AIRFRAME – PROPULSION SYSTEM INTERACTIONS	575
<i>Stephen Colbert, Damian Quinn, Declan Nolan, Rob Fox, Paul Haynes, James O'Doherty-Jennings</i>	
SIMULATED SCALABILITY OF DISCRETE LATTICE MATERIALS SUBSTRUCTURES TO COMMERCIAL SCALE AIRCRAFT	588
<i>Nick B. Cramer, Joseph Kim, Benjamin Jenett, Kenneth C. Cheung, Sean Swei</i>	
CRACK PROPAGATION IN AN ALUMINUM PLATE BONDED TO A GLARE PANEL: CASE STUDY	595
<i>Guilherme V. Silva, Mariano A. Arbelo, Marcelo R. Rodrigues</i>	

COMPLETE AIRCRAFT DESIGN II

THE AERODYNAMIC DESIGN OF A HIGH-ALTITUDE OPERATIONAL RETURNING UNMANNED SYSTEM FOR ATMOSPHERIC SCIENCE	606
<i>Timothy T. Takahashi, Philip R. Thomas</i>	
DESIGN OF A COMPACT VERTICAL TAKE-OFF AND LANDING PERSONAL AIR VEHICLE	642
<i>Robert D. Love</i>	
HYDROGEN POWERED LONG HAUL AIRCRAFT WITH MINIMIZED CLIMATE IMPACT	656
<i>Florian M. Troeltsch, Marc Engelmann, Anna E. Scholz, Fabian Peter, Jochen Kaiser, Mirko Hornung</i>	
DEVELOPMENT AND MANUFACTURING OF AN ALBATROSS-INSPIRED TILT-WING DRONE	670
<i>Leonardo Escamilla, Glen Throneberry, Gerardo Sanchez, Rui Vasconcellos, Abdessattar Abdelkefi</i>	
PARAMETRIC ANALYSIS OF AN ACTIVE WINGLET CONCEPT FOR HIGH ASPECT RATIO WING USING CFD/CSM COMPUTATIONS	678
<i>Martin Delavenne, Bernard Barriety, Fabio Vetrano, Valerie Ferrand, Michel Salaun</i>	
BIOMIMETIC AND BIOINSPIRED ANTI-PREDATOR DRONES	695
<i>Savannah Bradley, Mostafa Hassanalian</i>	
INVERSE AIRCRAFT DESIGN	709
<i>Jonathan Gibbs, Volker Gollnick</i>	

METHODS AND METAMODELS FOR PRELIMINARY DESIGN - WING STRUCTURE

EFFECT OF FREE-PLAY AND INITIAL CONDITIONS ON AEROELASTIC BEHAVIOR OF A MISSILE CANARD IN SUPERSONIC FLOW	737
<i>Mustafa Ozcatalbas, Bulent Acar, Sitki Uslu</i>	
APPLICATION OF MACROSCOPIC STRUCTURES ON DRAGONFLY WINGS TO AN AIRCRAFT DESIGN APPROACH	746
<i>Hiroki Kawabe, Yuichiro Aoki, Sunao Sugimoto, Toshiya Nakamura</i>	
AEROELASTIC ANALYSIS AND CHARACTERIZATION OF THREE-DEGREE-OF- FREEDOM SYSTEMS WITH DISCONTINUOUS NONLINEARITY	N/A
<i>Rui Vasconcellos, Adam Bouma, Flavio Marques, Abdessattar Abdelkefi, Muhammad Hajj</i>	

Author Index