Design of Interplanetary Trajectories for Uranus Probe and Orbiter Mission Including Two-Planet Saturn-Uranus Opportunity

Kyle M. Hughes
PhD Candidate
Purdue University

Purdue University:
Sarag Saikia
David Minton
James Longuski

NASA-Ames Research Center:
Parul Agrawal
Helen Hwang
Gary Allen
Ethiraj Venkatapathy

OPAG
August 25, 2015
Trajectories to Uranus

• Computed swath of trajectories to Uranus (all ballistic)
• Launch dates from 2023 to 2028 (5-day increments)
• Considered 17 gravity-assist combinations
• Modeled trajectories using patched-conics
• Delivered-mass estimated using SLS and Atlas V

SLS Block 1B Trajectory Results
Two-Planet Saturn-Uranus Mission Using SLS

Launch May 6, 2023
2.4 metric tons of delivered payload

Uranus Arrival: Deliver Probe+Orbiter
September 12, 2034
TOF$_{E-U}$ = 11.4 years
TOF$_{S-U}$ = 4.8 years
$V_{\text{entry}} = 23.0$ km/s

Saturn Flyby: Deliver Probe
November 28, 2029
TOF$_{E-S}$ = 6.6 years
$V_{\text{entry}} = 36.2$ km/s

Opportunity repeats every 45 years

Kyle M. Hughes