

THE BLUE FLAME TIMELINES

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I. X-1 TIMELINES

September 2, 1963

Ray Dausman watches first drag race at NHRA Indy Nationals and discusses possibility of rocket propulsion with colleague Dick Keller at IIT Research Institute.

Summer, 1964

HPR-25 tests – Ray Dausman and Dick Keller test their 25 pound thrust hydrogen peroxide monopropellant rocket using a bathroom scale and 16mm movie camera to record performance in Blue Island, IL, behind Ray Muller's home – LSR Phase 1.

September, 1964

Dick recognizes fellow hot-rodder Pete Farnsworth at Oswego, IL drag strip and discusses the rocket dragster concept

October, 1964

Ray and Dick discuss HPR-25 test results and concept for a rocket dragster at Pete's home in Milwaukee, Pete agrees to join project, moving on to LSR Phase 2 of the program

January, 1965

Dick writes first LSR proposal, "Development of a Land Speed Record Vehicle of Mach One Capability" to promote sponsor support and to help promote the three phase project to break the land speed record and the sound barrier

March, 1965

IITRI Spectra (IIT Research Institute monthly publication) announces the proposed rocket dragster project, "A Dragster's Dream"

Spring, 1965

Work begins on the X-1 rocket and chassis (Pete Farnsworth's garage in Milwaukee, WI)

June, 1965

HPR-2500 hydrogen peroxide rocket motor (built at IIT Research Institute machine shop) finished and the project first mentioned in *Drag World*, "Rocket Car Planned, a report by Ben Brown

April, 1966

Dick begins work at IGT as Chief Technologist, *Gas Reaction Kinetics Research* project sponsored by the American Gas Association

July 23, 1966

X-1 tests at Great Lakes Dragaway-

Dick operates the X-1 in two static tests in the shut off area alongside the track, then two runs on the drag strip.

One objective was to show the X-1 rocket throttle control by staging on the drag strip, then two short runs with 2 second burns to 70 or 80 mph; no parachutes were on the car.

August, 1966

Dick meets with Chuck Suba to propose driving the X-1

September 6, 1966

Chuck drives X-1 in first full 1/4-mile tests at Great Lakes Dragaway

7.19 seconds ET at 203.39 miles per hour, mentioned in *Drag World* report by Ben Brown

Fall, 1966

Ray moves to Milwaukee to work at Allis-Chalmers on fuel cell technology and assists Pete

April, 1967

Pete finishes X-1 bodywork, X-1 ready to run fully completed

Hydrogen peroxide fuel tank size restricted to assure rocket shut down in the 1/4-mile, coasting through the timing lights

1967 X-1 Drag Race Results

<i>Venue</i>	<i>Date</i>	<i>E.T., sec</i>	<i>Speed, mph</i>
Rockford, IL	08/13/67	6.30	200.000
Crown Point, IN	08/20/67	6.57	160.714
		6.41*	189.470
Union Grove, WI	09/02/67	7.06	152.520
		6.78	229.290
	09/03/67	6.42	214.280
		6.52	196.720
Rockford, IL	09/04/67	6.32	193.000
Alton, IL	09/10/67	6.77	174.000
		6.70	198.000
Cincinnati, OH	09/24/67	6.77	156.520
		6.53	170.770
Union Grove, WI	10/22/67	6.44	210.520

*Note: ET was given as 5.41 seconds, but not considered credible by Reaction Dynamics. That ET was never approached again.

February, 1968

Dick writes new LSR project proposal to gas industry following discussions with IGT Director Henry Linden; *"LNG Goes Supersonic"*

April, 1968

Dick revises LSR project proposal to the gas industry; *"Setting the New World Land Speed Record with LNG Fuel"*

May, 1968

Larger hydrogen peroxide fuel tank installed to run rocket through the 1/4-mile timing lights

1968 X-1 Drag Race Results

<i>Venue</i>	<i>Date</i>	<i>E.T., sec</i>	<i>Speed, mph</i>
Oswego, IL	05/26/68	6.28	214.280
		6.03	257.140
Rockford, IL	07/06/68	6.216	251.390
		6.072	248.610
Oklahoma City, OK	09/15/68	6.09	257.880
		5.90	265.480

October 13, 1968

Chuck Suba killed in Fuel Dragster crash at Rockford Dragway in Byron, IL

II. Initial LSR Project Sponsorship Correspondence

July 20, 1967

Contacted Ted Hollingsworth at STP Corporation in Des Plaines, IL with LSR proposal.

July 26, 1967

Dr. Henry Linden, director of the Institute of Gas Technology (IGT) at IIT, wrote to Chet Stackpole, American Gas Association (AGA) managing director, advising support for a land speed record (LSR) project and requesting sponsor support from the members of **\$124,000**.

August 10, 1967

Contacted William McCrary, manager of race tire development at Firestone Tire and Rubber Company regarding LSR tires for the project. Firestone had supplied Indy car tires and was kept in the loop during the X-1 project. Following Art Arfons high speed crash in 1966 at Bonneville, a decision was made to discontinue Firestone LSR support.

November 27, 1967

Clark Daugherty, president, Rockwell Manufacturing Company, responded to Dr. Henry Linden's memorandum that he saw the potential benefit of the LSR project.

November 30, 1967

Jack Tankersley, president of East Ohio Gas Company, wrote Dr. Henry Linden questioning whether any tire company had been contacted by Reaction Dynamics.

December 26, 1967

Jim Condon, executive vice president of Peoples Gas Light and Coke Company wrote Dr. Henry Linden with opinion that the project was too dangerous.

December 27, 1967

Bill Strauss, chairman and president, Northern Natural Gas Company, Omaha, wrote to Dr. Henry Linden that not much industry technical knowledge would be gained by supporting the project.

February 28, 1968

Dick Keller wrote Dr. Robert Rosenberg, manager of utilization research at IGT, that there had been discussions with Jerry Tiffin, product manager, race tire group, Goodyear Tire and Rubber Company. Tiffin proposed a meeting with the race tire sales and engineering group as well as the aerospace division to discuss possible areas of sponsorship. Those included:

- Race car tires for the LSR attempt
- Lightweight alloy wheels
- Disk brake system
- Costs of timing and course preparation
- Lightweight pressurized cryogenic LNG tank

- Lightweight pressure vessels
- Drag parachutes
- Supersonic braking system

April 8, 1968

Marvin Chandler, chairman and president, Northern Illinois Gas sent LSR proposal to 40 natural gas distributors, 5 pipeline companies, and 3 gas industry suppliers, requesting project support for **\$200,000**.

May 6, 1968

Dr. Robert Rosenberg wrote Henry Harper, vice president of public relations, Northern Illinois Gas, discussing positive natural gas safety argument for the project.

June 7, 1968

Dr. Robert Rosenberg wrote Harold Walker, director of public affairs, AGA, discussing natural gas safety and publicity benefits of the project.

July 10, 1968

Buell Duncan, president, American Gas Association, to cooperate with Henry Harper and Northern Illinois Gas in solicitation of project support of **\$225,000**.

July 30, 1968

Jack Reid, associate director at IGT, wrote to Pete Farnsworth of Reaction Dynamics authorizing initial expenditure up to \$50,000 to launch project and cover expenses until December 31, 1968. The Blue Flame project begins. LSR Phase 3 officially began.

Attached was a project timeframe with **estimated budget of \$147,000**, with record attempts scheduled in September through October, 1969.

III. Reaction Dynamics Progress Reports to IGT from August, 1968 through November, 1969

August, 1968

The LSR project began

Shop in Milwaukee was rented at 5254 N.124th Street

Dr. T. Paul Torda, associate professor of Mechanical and Aerospace Engineering at Illinois Institute of Technology (IIT) agreed to consult on the aerodynamics design and overall vehicle performance.

Tom Morel, a graduate student under Dr. Torda, begins working on his master's thesis research, *Aerodynamic Design of a High-Speed Rocket Car*.

September, 1968

The X-1 was prepared for the Oklahoma City jet car race – executives from Northern Illinois Gas, American Gas Association, and Institute of Gas Technology agreed to attend.

An agreement was signed with James McCormick of FMC Inorganic Chemicals Division to consult with Ray Dausman on the bipropellant propulsion system (LNG/HTP) design.

The Bonneville international course was surveyed to provide data for the vehicle suspension design.

Dr. S. Carl Uzgiris, assistant professor of Mechanical and Aerospace Engineering at IIT agreed to consult on the structural design of the vehicle and recruit engineering master's degree candidates for thesis research.

October, 1968

Chuck Suba, driver designate of The Blue Flame, was killed in a drag racing accident in a fuel dragster at the Rockford, Illinois dragstrip.

A driver replacement search was initiated. Five finalists were selected for interviewing after reviewing numerous resumes. The list included Don Garlits, Don Beeman, Doug Rose, Craig Breedlove, and Chris Karamesines. Experience in high speed race cars and public name recognition were considerations at this time.

Goodyear declined to provide any support beyond tires. The tire they will supply is the 8.00-25 LSR tire used on the front of Breedlove's Sonic 1 record-setter. It is 35 inches in OD. These are much larger than the Firestone 7.00-18, 28 inch OD tires that the vehicle design has been modeled to use. A search for a wheel supplier was begun.

The Ohio State University (OSU) transonic wind tunnel facility was contacted to provide data for the vehicle aerodynamic design.

A 1/5 scale model of The Blue Flame was built to use for PR appearances.

The propulsion system design was begun at Engineering Design Service Company in Buffalo, New York with Jim McCormick.

November, 1968

After interviewing the driver candidates, Don Garlits agreed to drive The Blue Flame. Dr. John D. Lee at OSU agreed to work with Dr. Torda and Tom Morel testing the land speed record vehicle design.

The propulsion system design is nearing completion and final construction cost quotation. Dr. Uzgiris recruited five additional graduate students to begin work on the vehicle structural design; Messrs. Adhikari, Desai, Kurani, Parikh, and Thakur. These are international students from India.

December, 1968

No report.

The AGA and IGT agreed to underwrite the **continuation of the LSR project to \$147,000**. Gary Gabelich spontaneously visited Reaction Dynamics to propose driving the X-1 rocket dragster. Since the car was retired, Gary left without a deal.

January, 1969

OSU wind tunnel testing has begun. Vehicle performance calculations were completed, driving the propulsion system final design and vehicle design.

Goodyear has required the tires not be run at speeds in excess of 700 mph for the first year's attempts at the land speed record.

In order to assure The Blue flame will stay within the speed cap, the rocket system has been configured to operate at a downrated maximum thrust for the lower speed runs.

The vehicle wheel design and chassis structural design drawings will begin to be available next month.

A quote for the rocket motor assembly has been firmed at \$27,000. The whole propulsion system will now cost \$79,000.

February, 1969

A permit for a record attempt in September, 1969 was cleared by Joe Petrali at United States Auto Club (USAC), the Bonneville Speedway Association, and ACCUS-FIA.

Reaction Dynamics, Inc. was registered as the USAC car owner of record.

Naming a reserve driver was contemplated in the event the driver designate was not available at the time of the record attempt.

Fabricating techniques, equipment and fixtures were developed at Reaction Dynamics.

OSU transonic wind tunnel work was completed. An unfaired rear strut design was selected based upon the OSU data, eliminating the wheel fairings and wing-like struts.

The 22,000 pound thrust rocket propulsion system fabrication was begun, delivery expected in May.

The hydrogen peroxide propellant tank was designed for fabrication.

A 750 mph wheel design was completed. This aluminum wheel is for the initial subsonic runs and may be replaced by a higher speed wheel later for supersonic record attempts.

March, 1969

The chassis jig was erected for assembly of the vehicle. A dimpling press was fabricated to prepare the skin panels for riveting.

Parachute canisters (3 pairs) were fabricated and shipped to Deist Safety Equipment for final assembly.

The construction and test calendar was revised.

April, 1969

The press kit was assembled for the AGA press conference at the Beverly Hills Hotel in California with Jim Chatfield. The Blue Flame LSR project was announced to the world.

Dr. Uzgiris evaluated possible instrumentation requirements and contacted NASA for an equipment loan.

The plumbing design layout was completed. The rocket assembly is now due for shipment in June instead of May.

Two additional mechanics were hired for fabrication in the shop.

Welding fixtures for the aluminum rings (ribs) were built and tested.

May, 1969

No report.

Don Garlits decided against driving just prior to the AGA press conference for family reasons.

Gary Gabelich was contacted and interviewed in Long Beach for the LSR driver position after the press conference.

June, 1969

The propulsion system control mechanism design was completed. It consists of a fluidic (air) binary pneumatic logic circuit.

LNG fuel lines are behind schedule.

The high pressure titanium nitrogen spheres are behind schedule.

The rocket assembly and hydrogen peroxide tank are now scheduled for July delivery.

The chassis central monocoque structure being assembled on the chassis fixture is nearing completion.

Aluminum forgings have been completed for the wheels and shipped to Cragar in California for final machining.

Gary Gabelich signed the driver agreement. A reserve driver will be named as well.

July, 1969

The rocket motor assembly arrived. After inspection, it was returned to the fabricator for necessary modifications. It is expected to be returned to Reaction Dynamics in August.

The hydrogen peroxide tank has arrived and all pressurized systems have been tested.

The Cragar wheels are in the machining process. The wheels will be assembled at Reaction Dynamics, then sent to Goodyear for tire mounting, balancing, and testing.

Parachutes are due from Deist in August.

The aluminum LSR vehicle trailer is under construction.

August, 1969

The rocket motor modifications are completed and the motor will be returned in September.
The completed fuel system has been tested and calibrated.
The monocoque chassis has been rotated upright on the assembly fixture for final assembly.
The first wheels have arrived from Cragar and prepared to transport to Goodyear in Akron, Ohio.

September, 1969

The complete propulsion system is ready to install in the chassis.
The monocoque hatch covers are nearing completion.
The front suspension and steering assemblies are being fabricated.
Formed aluminum rear body panels are ready for mounting.
The formed aluminum cockpit canopy is being fabricated.
The vertical stabilizer assembly is being fabricated in a fixture.
Twelve wheels were assembled and taken to Goodyear for balancing and dynamic testing.
The vehicle trailer is being assembled.

October, 1969

No report.

November, 1969

No report.

December, 1969

IGT assumes ownership of The Blue Flame due to contract default over 1969 contracted race date

1970 Events

January - Car taken from Reaction Dynamics to Illinois (IGT)

February - Returned to Reaction Dynamics for completion following TBF towing accident

April - Southern Gas Association appearance of The Blue Flame and Gary Gabelich to promote additional LSR funding at Houston AstroWorld Park week of April 28, 1970

July - Final static testing at Union Grove (Great Lakes Dragaway) drag strip, week of July 27, 1970

September 12, 1970

Reaction Dynamics crew and The Blue Flame leave Milwaukee shop and caravan to the Bonneville Salt Flats