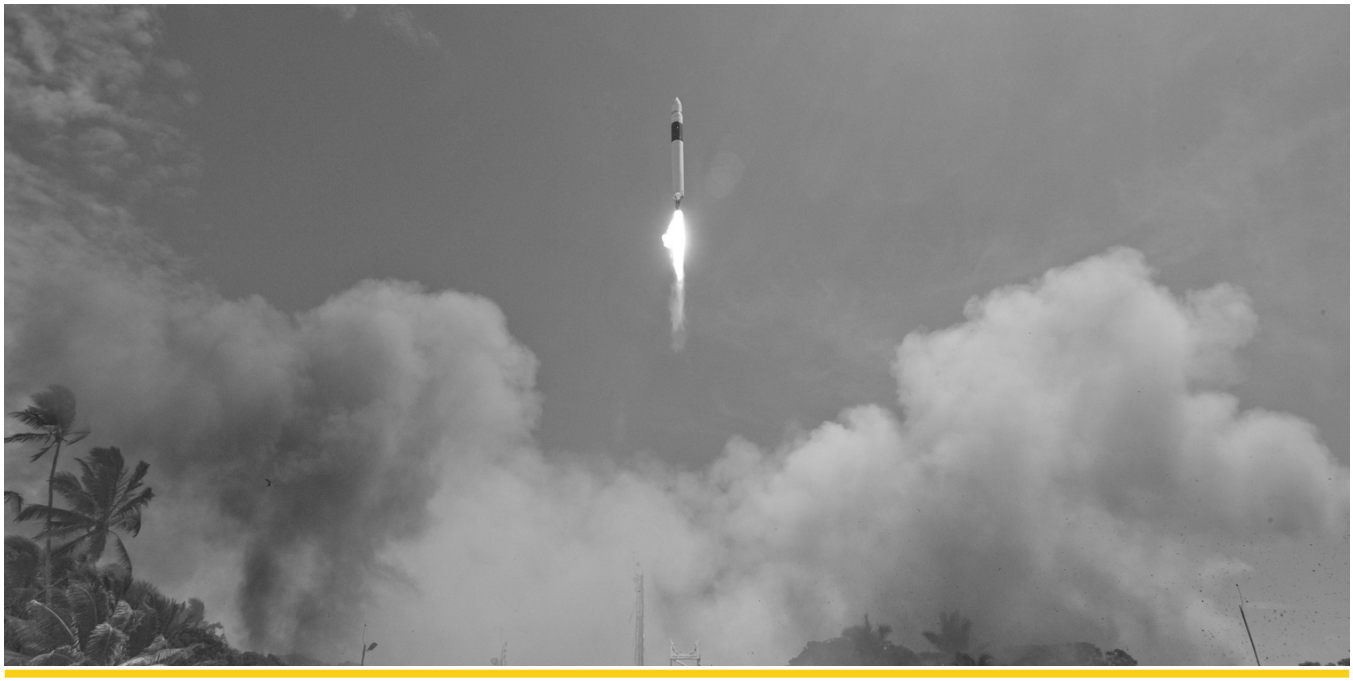
10 / OPPORTUNITY TO CREATE

SpaceX

The fourth attempt

When should a founder keep investing after repeated failure?



Falcon 1, fourth-flight launch, 2008. Photograph: SpaceX.
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Before Falcon 1’s fourth flight, a launch team must distinguish learning from persistence and choose how much evidence to buy before another attempt.

Elon Musk and the Falcon 1 team | August 2008 • reconstructed decision

35-45 minutes to prepare / 75 minutes to discuss
Original public-source teaching case • First member edition • 1 November 2026

PRINCIPLED BUSINESS IN PRACTICE

Introduction

About Principled Business

Principled Business (PB) is a nonprofit organization that brings together business leaders to advance capitalism through education, relationships and action. It helps founders, executives and investors understand free enterprise, apply its principles in their organizations, and explain the contribution business makes to people's lives.

The PB manifesto grounds capitalism in individual agency, private ownership and voluntary production and trade. These commitments take practical form in everyday business decisions.

Opportunity to create

PB emphasizes the freedom to pursue ideas and build enterprises. Turning that freedom into a useful business requires judgment about demand, resources and the consequences of failure.

SpaceX makes the opportunity to create visible under severe uncertainty. Repeated failure can reveal useful information, but it can also exhaust capital and encourage escalation. This case asks students to justify a further attempt using prospective evidence, adequate reserves and nonnegotiable safety conditions.

PB presents this case to make the principle usable in a real business decision. Your recommendation should connect the principle to a workable policy, account for the people affected, and identify evidence that could change your mind.

What you will learn

01 Distinguish learning from sunk-cost reasoning.

02 Compare expected value, cash requirements and sensitivity to uncertain probabilities.

03 Define evidence and independent review needed before another irreversible commitment.

> **Apply it to your own business**
> Which project in your organization has already consumed substantial resources? What new evidence, rather than past spending, would justify the next commitment?

Source: About Principled Business; Capitalists for Capitalism Manifesto, Section 2: Opportunity to Create.

NOTES FOR STUDENTS AND TEACHERS

Using this case study

This packet includes the case, exhibits, worksheet, sources, answers and teaching notes. Allow 35-45 minutes to prepare and 75 minutes for discussion. Have a calculator or spreadsheet available.

Pages	What to use and when
4-8	Decision, evidence, exercise and alternatives. Read before discussion.
9	Decision worksheet. Complete before reading the answers.
10	Sources and reading notes. Check the evidence and its limits.
11-12	Worked answers, outcome and teaching plan. Read after deciding.

For students

Read once to identify the decision, then work through the exhibits. Separate historical facts from the invented classroom exercise. Use the case's decision boundary; write down assumptions when evidence is missing. Complete the calculation and worksheet on page 9. Be ready to defend your recommendation and the strongest objection to it.

For individual study, decide before turning to pages 11-12. Compare your reasoning with the worked analysis and write a short reflection on what you would change. Choose one action to try in your own organization.

For teachers and discussion leaders

Read the full packet and timed plan before teaching. Assign pages 1-10 first and reveal the final two pages after students commit to a choice. Record the alternatives, evidence and disagreements on the board.

Keep every probability and financial value explicitly hypothetical. Separate the Falcon 1 decision from NASA's Falcon 9/Dragon development program, and keep safety outside a simple expected-value tradeoff.

> **How to assess the work**
> Look for a clear choice, accurate analysis, stated assumptions, attention to affected people, a fair objection, and an implementation plan with an owner and review point. Assess reasoning rather than agreement with the historical decision.

AUGUST 2008 • AFTER THE THIRD ATTEMPT

The decision

Falcon 1 had not reached orbit after its first three attempts. The third mission launched from Omelek Island in August 2008. A fourth attempt would require another commitment of hardware, people and money before success was assured. The later conference account describes the sequence of four flights. [X1-X2]

Take the leadership team’s position at this point. You can prepare another flight promptly, spend additional time on testing, or seek a financing or partnership arrangement that changes the scope and timing. The choice should depend on what the failures have taught the team and what uncertainty still matters.

The next dollar is a new decision

Past spending cannot be recovered by insisting that the next attempt must work. At the same time, abandoning a project after learning something valuable could discard an opportunity whose prospects have improved. The question is whether the evidence now supports the next commitment relative to its alternatives.

NASA’s commercial transportation development program is relevant context, but it is not interchangeable with Falcon 1. The Falcon 9/Dragon program had its own objectives and milestones. Do not assume those resources remove the need to assess this launch decision on its own terms. [X3-X4]

> **Decision boundary**
> Recommend a next step without using the fourth flight’s result. Safety, launch authorization and technical readiness must pass their required reviews under every option.

THE BUSINESS LOGIC

Persistence needs a theory of learning

Failure is informative only when interpreted

A failed attempt may identify a specific mechanism, expose an inadequate test or reveal that assumptions were wrong. “We learned a lot” is too vague to justify another launch. Leadership should ask what changed in the design, what evidence supports the correction and what independent reviewer could challenge the conclusion.

Testing has an opportunity cost

More testing consumes money and time. It is worthwhile when it changes a decision or improves the probability of an acceptable outcome enough to justify those costs. Tests that repeat what is already known can create confidence without resolving the uncertainty that matters.

Cash and expected value are different constraints

An attractive expected payoff does not fund a launch or preserve a team through a delay. A project can have positive expected value and still be unaffordable. The timing of obligations, minimum reserve and availability of credible financing therefore belong beside the technical argument.

A partnership could add capital, expertise or independent discipline, but it may also require control rights, a different schedule or a narrower goal. Compare the actual terms available rather than invoking an unspecified investor as a rescue plan.

> **A review question**
> If the team had not made the earlier attempts, would today’s evidence justify this next investment? Then ask what knowledge the earlier attempts created that a new entrant would lack.

EXHIBIT 1 • HISTORICAL BOUNDARY AND REVIEW QUESTIONS

Evidence before another launch

Public context	Question for the decision-maker
Three Falcon 1 attempts preceded the fourth. [X2]	Which uncertainties have narrowed, and which remain?
The third attempt occurred in August 2008. [X1]	What can be responsibly verified before another flight?
Commercial development partnerships used milestones. [X3]	What observable evidence should unlock the next commitment?
Falcon 9/Dragon was a distinct program. [X4]	Which resources are actually available for this decision?

An evidence package

Require a documented account of the failure, the proposed correction, test coverage and unresolved questions. Identify who is independent of the delivery schedule and authorized to stop the launch. A founder’s conviction is relevant motivation, but it is not a substitute for technical acceptance.

A capital package

Show committed spending, timing, reserve requirements and financing conditions. Separate cash already secured from funding still being negotiated. Identify what obligations survive if the team postpones or stops.

> **What the next exhibit cannot establish**
> The probabilities and payoff estimates are invented for teaching. They are not engineering reliability assessments and cannot authorize a launch or override a safety review.

EXHIBIT 2 • INVENTED CLASSROOM EXERCISE

The value of another test

Use hypothetical U.S. dollars in millions. Available cash is $60m and the required reserve is $20m. A flight costs $18m; ongoing cash burn is $4m per month. Treat costs as certain and paid before the result. Both options must pass all required safety and authorization reviews.

Option	Time to flight	Extra test cost	Assumed success probability
A. Prepare promptly	1.5 months	$0m	45%
B. Additional testing	3 months	$6m	65%

For a simplified expected-value comparison, the program value after success is $90m and after failure $10m, before subtracting this decision's costs. These invented values exclude the cash reserve and are not company valuations. Ignore discounting, financing and any value beyond the two outcomes.

01 Calculate total pre-result spending and remaining cash for each option. Does each preserve the reserve?

02 Calculate expected program value net of decision cost.

03 What success probability would B need to equal A's expected net value?

04 If B takes one extra month, how do cash and expected value change?

> **State the uncertainty**
> The difference between 45% and 65% is an assumption to test. Do not present the exercise's assumed improvement as evidence that extra testing actually produces it.

ALTERNATIVES • IMPLEMENTATION • ASSIGNMENT

Authorize the next commitment

Path	Case for it	Evidence required
Prepare promptly	Use a verified correction while limiting cash burn.	Readiness evidence and an adequate reserve.
Test further	Buy information or reliability before a costly attempt.	A specific unresolved issue and a test that can address it.
Finance, partner or narrow scope	Preserve the opportunity under different constraints.	Credible terms, timing and responsibilities.

Your assignment

01 Choose the next commitment and distinguish its technical, financial and safety conditions.

02 Identify the evidence supporting your probability assumption. If unavailable, state a range.

03 Set a budget, review date and authority to stop or postpone.

04 Explain why your recommendation avoids both blind persistence and automatic abandonment.

Write a short board recommendation that includes the strongest argument against proceeding. Identify what would make you revise it before the next irreversible expense. Do not rely on money that has not been committed.

> **A demanding test**
> A good continuation decision explains why the next attempt is better supported than the last. It does not simply repeat the importance of the ambition.

WORKSHEET • COMPLETE BEFORE READING THE TEACHING NOTES

Your decision

Write as the decision-maker. Use the historical evidence and the classroom model for their stated purposes. A recommendation needs a boundary, an owner and a test.

My recommendation and the principle it puts into practice

The calculation or evidence that matters most; its main limitation

Who bears the risk, and how their choice or voice is protected

The strongest objection and my response

First action, accountable owner, review date and stop/change trigger

EVIDENCE • METHOD • LIMITS

Sources and reading notes

A reconstructed decision after Falcon 1's third attempt in August 2008. Public mission records and a SpaceX-authored conference account establish chronology. No actual cash balance, success probability or private deliberation is supplied.

X1 SpaceX, Trailblazer Mission

Company record of the August 2008 Falcon 1 attempt from Omelek Island.

Open source document →

X2 DiNardi and Bjelde, 2009 Small Satellite Conference

SpaceX-authored account, Falcon 1 Flight Results and Multiple Payload Integration; later outcome and development context.

Open source document →

X3 NASA, commercial space transportation partnership, 19 February 2008

Public development program context and milestone-based funding arrangements.

Open source document →

X4 NASA, COTS program completion, 2013

Clarifies the separate Falcon 9 and Dragon program; used for context, not 2008 foresight.

Open source document →

How to read the evidence

The conference account is by company participants and is retrospective. The case does not assert a "last dollar" narrative or treat public contracts as unrestricted cash for Falcon 1. Dates can differ by time zone; the decision is bounded at August 2008.

All quantities in the classroom exercise are invented unless explicitly identified as historical. The models omit factors deliberately for discussion; they are not company forecasts. Photographs are documentary context, with dates and licenses on the cover.

Original Principled Business teaching material. No company approval or affiliation with Harvard Business School is implied. No private interviews or unpublished company records were used. Public sources checked 1 November 2026.

TEACHING NOTES • READ AFTER COMPLETING THE DECISION

Worked analysis

Cash and expected value

Measure	A	B
Decision cost	$18m + $6m = $24m	$18m + $12m + $6m = $36m
Cash remaining	$36m	$24m
Expected gross program value	$46m	$62m
Expected net value	$22m	$26m

Both preserve the $20m reserve in the base case. Expected gross value is $90p + 10(1 - p)$. B's break-even probability against A is found from $80p + 10 - 36 = 22$, giving $p = 60\%$. Above that estimate, B has higher expected net value within this model.

One month changes the margin

An additional month raises B's cost to $40m and leaves $20m cash, exactly the reserve. At the assumed 65% probability, its expected net value falls to $22m, matching A. Any further unmodeled cash requirement would breach the reserve.

What justifies the recommendation?

B is attractive only if the test credibly improves the relevant probability and can be delivered within the budget and time limit. A may be preferable if the correction is already adequately verified. Neither calculation can waive readiness or safety requirements. A recommendation should state a probability range and show whether the ranking survives it.

> **Avoid hindsight**
> A later successful flight cannot prove that every prior expenditure was justified. Evaluate the information, alternatives and constraints available when the decision was made.

TEACHING NOTES • READ AFTER COMPLETING THE DECISION

Outcome and teaching plan

What happened next

Falcon 1's fourth flight reached orbit on 28 September 2008. SpaceX participants later documented the four-flight development sequence. This establishes the historical result, while leaving the classroom question intact: what evidence would have justified the commitment before success was known? [X2]

A 75-minute discussion

Minutes	Facilitation plan
0-10	Vote on prompt preparation, testing or a revised financing path.
10-25	List the knowledge that would justify another attempt.
25-40	Calculate cash, expected value and the delay sensitivity.
40-55	Design independent readiness and capital review gates.
55-65	Reveal the outcome and challenge hindsight-based arguments.
65-75	Apply the continuation test to a project with substantial sunk costs.

> **Closing question**
> What new evidence must accompany the next request for resources when a project has repeatedly failed to deliver?

Assess the decision at its stated boundary. Later success cannot prove the original choice was sound; later failure cannot, by itself, prove it was unreasonable.